NATIONAL BOARD FOR TECHNICAL EDUCATION

NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATION

OCTOBER, 2018

GENERAL INFORMATION

1.0 CERTIFICATION AND TITLE OF THE PROGRAMME:
The certificate to be awarded and the programme title shall read: "**NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY"**

2.0 GOAL AND OBJECTIVES:
The National Diploma Programme in **Railway Engineering Technology** is designed to produce diplomates with skills and knowledge to be able to function as technicians in the railway and other related industries such as construction, enninronmentalsector,etc.

On completion of this programme, the diplomate should be able to:

i. Participate in the construction and installation of railway works;
ii. Perform basic railway operations;
iii. Apply general health, safety rules and environmental management in railway transportation industry;
iv. Assist in the maintenance of railway systems;
v. Assist in carrying out basic survey and compilation of inventory;
vi. Writing technical reports on railway assets and activities;
vii. Assist in carrying out basic tests on geotechnical and materials engineering;
viii. Assist in preparing and interpreting basic engineering drawings;
ix. Participate in the planning and development of railway right-of-way;
x. Establish and manage an enterprise;

3.0 ENTRY REQUIREMENTS:
Entry requirements for the National Diploma in Railway Engineering Technology programme include at least a minimum score in the Unified Tertiary Matriculation Examination (UTME), five credit passes at not more than two sittings in West African Senior School Certificate of Education (WASSCE), Senior School Certificate of Education (SSCE), National Technical Certificate (NTC), General Certificate of Education (GCE) Ordinary level, or the West African Examination Certificate (WAEC) in relevant subjects. The relevant subjects are: English Language, Mathematics, Physics, Chemistry and one other subject from: Metal Work, Wood Work, Technical Drawing, Basic Electronics, Basic Electricity, Economics, Commerce, Statistics, Further Mathematics, Computer Studies, Geography and Biology or Agricultural Science. (Details of Admission requirements are obtainable in the NBTE annual Directory of Acceditated Programmes).

4.0 CURRICULUM
4.1 The curriculum of the ND programmes consists of the following four main components: General Studies/Education

i. Foundation courses
ii. Professional courses
iii. Supervised Industrial Work Experience Scheme (SIWES)

4.2 The General Education Components shall include courses in:

- Art and Humanities – English Language, Communication, History
- Social Studies – Citizenship Education, Political Science, Sociology, Philosophy, Geography and Entrepreneurship Studies

The General Education component shall account for not more than 15% of total contact hours for the programme

4.3 Foundation Courses include courses in Mathematics, Pure Science, Technical Drawing, Descriptive Geometry, etc. The number of hours will be 10 -15% of the total contact hours.

4.4 Professional Courses are courses which give the student theory and practical skills he needed to practice at the Technician level. These may account for 60-70% of the contact hours.

4.5 Student 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 of SIWES at paragraph 9.0.

5.0 Curriculum Structure:

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

- 15 contact weeks of teaching, i.e. recitation, practical exercises, quizzes, test, etc; and
- 2 weeks for examinations and registration.

SIWES shall take place at the end of the second semester of the first year.

6.0 PROJECT

Project shall be submitted at the end of the second semester of the final year.

7.0 ACCREDITIATION

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 two diploma certificates. Details about the process of accrediting a programme for the award of ND or HND are available from the Executive Secretary, National Board for Technical Education, Plot B Bida Road, P.M.B. 2239, Kaduna, Nigeria.

7.1 Conditions for the Award of ND:

Institutions offering accredited programmes will award the National Diploma to candidates who successfully completed the programme after passing prescribed course-work, examinations, diploma project and the supervised industrial work experience. Such candidates should have completed a minimum of 90 and 100 semester credit units. National Diploma Certificateshall be awarded based on the following:-

i. Grading of Courses: Courses shall be graded as follows:

MARKED	LETTER GRADE	WEIGHTING
75% and above	A	4.00
70% – 74%	AB	3.50
65% – 69%	B	3.25
60% – 64%	BC	3.00
55% – 59%	C	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	E	2.00
Below 40%	F	0.0

ii. Classification of Diplomas: Diploma Certificates shall be awarded based on the following classifications:

Distinction - CGPA 3.50-4.00
Upper Credit - CGPA 3.00-3.49
Lower Credit - CGPA 2.50-3.00
Pass - CGPA 2.00-2.49

8.0 Guidance Notes for Teachers of 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 In designing 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 purposes

8.3 As the success of the credit unit system depends on the articulation of programmes between the institution and industry, the Curriculum content has been

written in behavioral 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 is 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 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 exist 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 course, 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 30 of each year, six copies of the 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 should 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 the 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, cognizance 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 student's work which has been agreed to by polytechnics is adopted.

9.4 The Institution Based Supervisor

The Institution-based supervisor should initiate the log book during each visit. This will enable him to check and determine to what extent the objective 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; and
2) A final visit in the last month of the attachment

9.6 Stipends 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 isan 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 DIPLOMA (ND) IN RAILWAY ENGINEERING TECHNOLOGY

ND I SEMESTER ONE :

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1	GNS 101	Use of English I	2	0	0	2	2
2	GNS 111	HIV/AIDS, Psychoactive Substances Use (Drug Abuse) and Citizenship Education	2	0	0	2	2
3	MTH 111	Logic and Linear Algebra	2	0	0	2	2
4	MEC 112	Technical Drawing	2	0	2	4	4
5	SUG 101	Basic Principles in Surveying I	1	0	3	4	4
6	CEC 108	Engineering Geology and Basic Soil Mechanics	2	0	3	5	5
7	1CT 101	Introduction to Computing	1	0	3	4	4
8	RWE 111	Principles of Railway Engineering and Operations	2	0	1	3	3
9	RWE 112	Railway Workshop Technology and Practice	2	0	2	4	4
Total			16	0	14	30	30

ND I SEMESTER TWO:

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1	GNS 121	Citizenship Education II	2	0	0	2	2
2	GNS 102	Communication in English I	2	0	0	2	2
3	EED 126	Introduction to Entrepreneurship	1	0	2	3	3
4	MTH 113	Algebra and Elementary Trigonometry	2	0	0	2	2
5	CEC 104	Science and Properties of Materials	2	0	3	5	5
6	SUG 102	Basic Principles in Surveying II	1	0	3	4	4
7	RWE 121	Basic Signaling and Communications	1	0	2	3	3
8	RWE 122	Introduction to Railway Track Technology	2	0	2	4	4
9	RWE 123	Rolling Stock Technology	1	0	2	3	3
10	RWE 124	Technical Report Writing	2	0	0	2	2
Total			16	0	14	30	30

ND II SEMESTER THREE:

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1	GNS 201	Use of English II	2	0	0	2	2
2	EED 216	Practice of Entrepreneurship	1	0	3	4	4
3	MTH 114	Calculus	2	0	0	2	2
4	SUG 208	Engineering Surveying I	2	0	1	3	3
5	RWE 211	Railway Engineering Drawing	1	0	2	3	3
6	RWE 212	Rail Systems Maintenance	2	0	2	4	4
7	RWE 213	Railway Operations and Infrastructure Management	2	0	0	2	2
8	RWE 214	Introduction to Train Movement and Control	2	0	2	4	4
9	RWE 215	Railway Signaling and Communications	2	0	2	4	4
10	RWE 126	Structural Mechanics	2	0	0	2	2
Total			18	0	12	30	30

ND II SEMESTER FOUR:

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1	GNS 202	Communication in English II	2	0	0	2	2
2	MTH 112	Trigonometry and Analytical Geometry	2	0	2	4	4
3	GIT 201	Elements of Geo-Informatics	1	0	3	4	4
4	RWE 221	Railway Economics and Planning	2	0	0	2	2
5	RWE 222	Railway Track Construction	2	0	2	4	4
6	RWE 223	Soil and Rock Mechanics	2	0	1	3	3
7	RWE 224	Strength of Materials	2	0	1	3	3
8	RWE 225	Final Year Project	0	0	4	4	4
Total			13	0	13	26	26

ND I SEMESTER ONE

PROGRAMME: ND RAILWAY ENGINNERING TECHNOLOGY		
COURSE TITLE: USE OF ENGLISH LANGUAGE I	**CODE:** GNS I01	**CREDIT HOURS:** 2 HR
YEAR: ND I	**PRE-REQUISITE**	**THEORETICAL: HOURS/WEEK**
SEMESTER :1ST		**PRACTICAL:**
GOAL: This course is designed to provide the student with the language skills which will enable him to cope effectively with the challenges of his course, to use English Language effectively in the practice of his chosen profession as well as interact with others in the society.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1. Know the nature of language. 2. Understand the basic rules of grammar. 3. Learn the essential qualities of paragraphs, 4. Acquire appropriate study skills. 5. Appreciate literary works in English.		

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE: USE OF ENGLISH LANGUAGE I	**CODE:** GNS 101	**Credit Unit:** 2.0	**CONTACT HOURS:** 2
GOAL: This course is designed to provide the student with the language skills which will enable him to cope effectively with the challenges of his course, to use English Language effectively in the practice of his chosen profession as well as interact with others in the society.			
GENERAL OBJECTIVE 1.0: Develop appropriate study skills.			

THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Wk	**Specific Learning Outcome**	**Teachers' Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers' Activities**	**Evaluation**
1-3	1.1 Explain the necessity for acquiring good note taking/ making techniques. 1.2 List the methods of note-taking/ making. 1.3 Use the dictionary correctly. 1.4 List information sources in the Library. 1.5 Identify good reading habits. 1.6 Explain the different methods of reading, viz., scan, skim etc.	➢ Define note taking/making. ➢ Explain the importance of note taking/making. Discuss different methods of note taking/making. Explain the use of dictionary. Expose students to sources of library information. Explain good reading habits. Enumerate the different methods of reading.	Whiteboard Marker Textbooks Projector Dictionary Reference Books, Library	Demonstrate good note taking skills in English. List the methods of note taking/making in English. Use the dictionary correctly . Locate information in the sources listed in 1.4 above. Practice good reading habits. ➢ Explain the different methods of reading. ➢ Use the different methods of reading explained in 1.6 above.	Guide, supervise and correct students' activities.	Class work, Assignment and Test.

	GENERAL OBJECTIVE 2.0 Know the nature of Language					
4-5	2.1 Define the concept of language. 2.2 List the characteristics of language. 2.3 Explain the four language skills, viz., speaking, listening, writing, reading. 2.4 State the functions of language. 2.5 List the uses of English Language in Nigeria, e.g. as the language of research, government, commerce etc.	Explain the concept of language. List and explain the characteristics of language. Explain the four language skills in their appropriate order. Explain the functions of language. Explain uses of English Language in Nigeria.	Textbooks Overhead Projector Tape recorder CD etc	Explain the concept of Language. State the characteristics of language. Apply the four language skills in their order. State the functions of Language. State the uses of English Language in Nigeria.	Guide, supervise and correct students' activities.	Class work, assignment, test.
	GENERAL OBJECTIVE 3.0 Understand the basic rules of grammar					
6-9	3.1 Define grammar 3.2 List parts of speech. 3.3 Explain the use of parts of speech in sentences. 3.4 List punctuation marks. 3.5 Enumerate the uses of punctuation marks. 3.8 Explain affixation.	Explain grammar. Explain parts of speech. Analyse the use of parts of speech in sentences. Explain punctuation marks. Explain the uses of punctuation marks. Define Affixation.	Textbooks Overhead Projector Tape recorder CD etc.	Enumerate parts of speech. Identify parts of speech in sentences. Use parts of speech appropriately in sentences. List punctuation marks. ➢ Enumerate the uses of punctuation marks. ➢ Punctuate given sentences paragraphs and passages. ➢ Identify prefixes and suffixes. ➢ Form words with suffixes and affixes.	Guide, supervise and correct students' activities.	Class work, assignment, test. "

	GENERAL OBJECTIVE 4.0 Know the essential qualities of paragraphs.					
10-12	4.1 Define a paragraph. 4.2 Name the parts of a paragraph, viz., topic sentence, development, and conclusion/ transition. 4.3 List the thematic qualities of a paragraph, viz unity, coherence and emphasis. 4.4 Enumerate methods of paragraph development viz: Example, definition, comparison, contrast etc.	Explain paragraphing. Explain the parts of a paragraph. Explain the thematic qualities of paragraph. Explain methods of paragraph development.	Textbooks Overhead Projector Tape recorder CD/DVD etc.	➢ Define paragraph. ➢ Identify the number of paragraphs in a given passage. Identify the parts of a paragraph in a passage. Identify the thematic qualities of a paragraph. List methods of paragraph development. Write specific paragraphs to illustrate 4.2 and 4.4.	Guide, supervise and correct students' activities.	Class work, Assignment, Test
	GENERAL OBJECTIVE 5.0 Appreciate literary works in English.					
13-15	5.1 Define Literature. 5.2 Trace the development of literature. 5.3 List the functions of Literature. 5.4 Differentiate between the literary genres. 5.5 Enumerate the terminology of prose fiction, e.g., plot setting, characterization etc. 5.6 Explicate a novel.	Explain the concept of Literature. Explain the development of Literature. Explain the functions of Literature. Explain the genres of Literature. ➢ Explain the terminology of prose.	Textbooks Projector White Board Marker Internet Tape recorder CD/DVD etc.	Define Literature. Trace the development of Literature. List some functions of Literature. Differentiate between the literary genres. ➢ List the terminology of prose.	Guide, supervise and correct students' activities.	Class work, Assignments, Test

		Present questions in a given novel and assign characters to the students.		➢ Answer questions on a given novel. ➢ Role play the characters in the novel.		

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

Programme: NATIONAL DIPLOMA IN RAILWAY ENGINEERINGTECHNOLOGY	**Course Code: GNS 111**	**Credit Hours: 2**
Course: HIV/AIDS, Psychoactive Substances Use (Drug Abuse) and Citizenship Education	**Pre-Requisite: - None**	**Theoretical: 2 Hours/Week**
Year : ND I Semester: 1		**Practical: 0 Hours/Week**

Goal: The Course is designed to educate the student on HIV/AIDS, Psychoactive Substances Use (Drug Abuse) and provisions of the Nigerian Constitution.

GENERAL OBJECTIVES

On completion of this course, the Student should be:

1.0. Understand the Constitution of Nigeria
2.0. Understand the Federal System of Government of Nigeria.
3.0. Know the Constitutional Rights and Obligations of Nigerian Citizens.
4.0. UnderstandCitizenship.
5.0. Understand Psychoactive Substances Use (Drug Abuse)
6.0. Understand HIV and AIDS
7.0. Know the Fundamental Objectives and Directive Principles of State Policy of Nigeria.

Programme: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
Course: **HIV/AIDS, Psychoactive Substances Use (Drug Abuse) and Citizenship Education**			Course Code: GNS111			CH/CU Hours: 2
Goal: The Course is designed to educate the student on HIV/AIDS, Psychoactive Substances Use (Drug Abuse) and provisions of the Nigerian Constitution.						
General Objective 1.0: Understand the Constitution of Nigeria						
Course Specification: THEORETICAL CONTENT						
	THEORETICAL CONTENTS		**PRACTICAL CONTENTS**			
WEEK/S	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1-2	1.1. Explain the term "Constitution". 1.2. Distinguish the different types of constitutions 1.3. Highlights some provisions of an international constitution. 1.4. Assess the effectiveness of international constitution 1.5. Recognise the supremacy of the Nigerian constitution to other laws. 1.6. Evaluate the main parts of the Nigerian constitution. 1.7. Trace the historical development of the Nigerian constitution. 1.8. Outline the merits and demerits of each of the Nigerian constitutions.	Explain the term and different types of constitution. Explain functions of constitutions. Explain the supremacy of the constitution to other laws. Explain the main parts of the Nigerian constitution.	The Constituion of Nigeria	Draft a constitution for an imagined association.	Assist students to draft the constitution for an imagined association	Constitution

	1.9. Explain the concepts of the " rule of law"					
GENERAL OBJECTIVE: 2.0: Understand the Federal System of Government of Nigeria.						
3-5	2.1 Describe a federation. 2.2 Distinguish a federation from a confederation. 2.3 Outline the basis for federal system in Nigeria. 2.4 Examine the evolution, structure and functions of the federal system of Nigeria. 2.5 Analyse the relationships among the three tiers of government in Nigeria. 2.6 Compare and contrast other federations with Nigeria.	Describe federation and confederation. State the basis for the Nigerian federal system. Outline the evolution of Nigerian Constitutions. Explain the three tiers system govenrmrnt in Nigeria. Explain the revenue allocation system in Nigeria. Outline other federal systems of government.	Constitution Diagram of federal and confederal systems of government,	Draw diagrams of federal and confederal systems of government.	Assist students to draw the diagrams of federal and confederal systems of government.	Costitutions.
GENERAL OBJECTIVE: 3.0: Know the Constitutional Rights and Obligations of Nigerian Citizens.						
6-8	3.1 State the rights and obligations of Nigerias under the constitution. 3.2 Examine the significance of rights and obligations in Nigeria. 3.3 Assess government's protection of	Explain the rights and obligations of Nigerias as provided in the constitution Describe constituted authorities and their duties.	Constitution of Nigeria Diagram on rights and obligations of citizens.	Draw Diagrams of rights and obligations of citizens.	Assist students to draw the diagrams	Diagramms charts on constitution rights and obligations.

	fundamental rights as contained in the Nigerian Constitution. 3.4 Evaluate the responsibilities and duties of Nigerian citizens and the benefits of performing them. 3.5 Assess the responsibilities and duties of constituted authorities and government to the people of Nigeria.					
General Objective: 4.0. : Understand Citizenship						
9-10	4.1 Describe the types of citizenship in Nigeria. 4.2 Explain the differences in the mode of acquiring citizenship. 4.3 Outline the significance of citizenship. 4.4 Analyse the principles and benefits of citizenship. 4.5 Evaluate the merits and demerits of each type of citizenship. 4.6 Analyse the basis for the acquisition and withdrawal of Nigerian citizenship. 4.7 Examine the benefits derivable	Describe citizenship and types provided in the Nigerian constitution. Describe the modes of acquisition of citizenship as provided in the Nigerian constitution	Constitution of Nigeria	Draw charts on how to acquire and lose citizenship	Assist students to draw the charts	Nigerian constitution.

	from Nigerian citizenship.					
GENERAL OBJECTIVES: 5.0: Understand Psychoactive Substances Use (Drug Abuse)						
11	5.1 Define drugs. 5.2 List types of drugs 5.3 List the types of drugs under the dangerous drugs Act (DDA). 5.4 Explain the following terms: - Hard drugs - Drug usage - Drug dependence - Drug abuse/violence - Drug pusher. 5.5 State the purposes for drug usage 5.6 State the couses of drug abuse by young people. 5.7 List the immediate and long-term effects of drug abuse on the following: - Individual - Family - Community - Country 5.8 Explain the drug policy of Nigeria.	Explain activities 5.1- 5.8 to students.	Relevant publications Relevant films Projector Federal Ministry of Health drugs policy documents Infromation Education and Communication materials, i.e. posters, charts, bill-boards, pamphlets, bulletins, etc	Idenify types of drugs Describe the signs and symptoms of drug abuse in an individual Establish anti-drug abuse club.	Show different types of drugs Show films Where possible, conduct visits to psychiatric hospitals Organise rallies/public lectures to create awareness during orientation Facilitate establishment of club Organise talks by NDLEA Procure appropriate IEC materials for demonstration.	Various types of DDA and non-DDA drugs Relevant flims.

GENERAL OBJECTIVE: 6.0 Understand HIV and AIDS						
12-13	6.1 Define the following: - STIs - HIV - AIDS 6.2 Outline the history of HIV and AIDS 6.3 Differentiate HIV from AIDS 6.4 Describe signs and symptoms of AIDS 6.5 Explain the following terms: - Infection/infectivity - Risk factor - Family life and HIV/AIDS education - Mode of transmission of infection/ways it cannot be transmitted. - Wellness state/health - Abstinence - Prevention of disease - Denial,stigma and discrimination - Treatment of disease - People living with HIV/AIDS - Epidemic/pandemic - People affected by AIDS (PABA) - Faithfulness - Causative factor - Carriers	Define STIs, HIV and AIDS. Explain STIs with examples Narrate the history of HIV and AIDS in Nigeria Explain the difference between HIV and AIDS Explain the terms listed in 6.5 Explain the effects of AIDS Describe the roles of government, NGOs, international organisations etc.	Films, TV set, VCR, VCD players, posters, journals, charts.	View films on: - Modes of transmission of HIV/AIDS. - People at risk of contracting HIV/AIDS - Signs and symptoms of AIDS - Screening of HIV/AIDS patients View Information Education and Communication materials that demonstrate preventive mearsuresfo HIV/AIDS. Establish anti-AIDS club.	Show relevant films on HIV/AIDS Procure Appropriate Information Education Communication materials for demonstration. Invite experts to give talks Organise rallies and lectures during orientation. Facilitate establishment of anti-AIDS club	Films, TV set, VCR, VCD players, posters, journals, charts

	- Window period - HIV counseling and testing - Diagnosis - Orphans and vulnerable children (OVC) 6.6 State the effects of AIDS on the : - Individual e.g., learner, teacher and others - Family - Institution - Community - Country 6.7 Analyse decision making skills on sexuality issues such as: - Sexual values - Goal-getting - Friendship and peer pressure - Setting limits on relationships - Risks of pre, extra-marital, and unprotected sex - Communication skills - Finding information and help 6.8 Explain how to relate with people living with HIV/AIDS and people affected by HIV/AIDS 6.9 State the role of Government,					

	NGOs, international organizations, faith-based organizations, community-based support groups and other agencies in the prevention and control of HIV and AIDS					
GENERAL OBJECTIVE: 7.0 Know the Fundamental Objectives and Directive Principles of State Policy of Nigeria.						
14-15	7.1 State the fundamental obligations of government as provided in the constitution. 7.2 Explain the general provisions of the Fundamental Objectives and Directive Principles of State Policy of Nigeria. 7.3 Explain the political, economic, social and educational policies of Nigeria. 7.4 Explain the Directive Principles and Policies of the media, national ethics and duties of the citizen. 7.5 Assess the conformity, observation of the Fundamental	Explain the Fundamental Objectives and Directive Principles of State Policy of Nigeria. Examine the conformity with the objectives by all tiers and arms of government and people of Nigeria.	Constitution of Nigeria.	Debate the conformity, observance and application of the Fundamental Objectives and Directive Priciples of State Policy by any tier or arm of government. Recommend improvement on the provisions, conformity, observance and application of the Directive Principles of State Policy.	Provide guidance for the debate.	Constitution of Nigeria.

	Objectives and Directive Principles of State Policy by government and people of Nigeria					

TEACHING STAFF FOR THE DRUG ABUSE AND HIV/AIDS COMPONENTS OF THE GENERAL STUDIES CURRICULUM

1. To get the best delivery, qualified medical doctors should teach these component.
2. Pharmacist would be suitable to teach the drug abuse component.
3. Staff with degrees in Nursing, Health Education or Clinical Psychology may be deployed when doctors or pharmacists are not available.
4. The drug abuse component may be taught by lecturers with degrees in Biology, Microbiology, or Parasitology.
5. The HIV/AIDS component may be taught by lecturers with degrees in Virology, Microbiology, Biology or Parasitology.
6. Where medical doctors are not available, and other professionals have to be engaged to teach, these should be given adequate training to enhance their capacity for effective delivery.

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONA DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: LOGIC AND LINEAR ALGEBRA	**COURSE CODE: MTH 111**	**UNIT: 2**	**CONTACT HOURS: THEORETICAL: 2HOURS/WEEK**
YEAR : ND I SEMESTER: 1	**PRE-REQUISITE: -**		**PRACTICAL: 0 2HOURS/WEEK**

Goal: To enable students develop precise, logical and abstract thinking and the ability to recognize, formulate, and evaluate problems in their areas of specialization

General Objectives

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

1. Understand basic rules of mathematical logic and their application in mathematical proofs.
2. Know the concept of Permutation and Combination.
3. Compute the Binomial expansion of algebraic expressions.
4. Understand Algebraic operations on matrices and determinant.

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE: LOGIC AND LINEAR ALGEBRA	**CODE: MTH 111**	**UNIT: 2**	**CONTACT HOURS/CU: 2**
			THEORETICAL: 2 Hours/Week
SEMESTER: 1	**PRE-REQUISITE: -**		**PRACTICAL: 0 Hours/Week**

GOAL: To enable students develop precise, logical and abstract thinking and the ability to recognize, formulate, and evaluate problems in their areas of specialization

GENERAL OBJECTIVE 1.0: UNDERSTAND BASIC RULES OF MATHEMATICAL LOGIC AND THEIR APPLICATION IN MATHEMATICAL PROOFS

THEORETICAL CONTENTS			**PRACTICAL CONTENTS**			
WEEK/S	**SPECIFIC LEARNING OUTCOMES FOR STUDENTS**	**TEACHER'S ACTIVITY**	**RESOURCES**	**SPECIFIC LEARNING OUTCOME**	**TEACHER'S ACTIVITY**	**RESOURCES**
1-4	1.1 Define the essential connectives such as conjunction, disjunction, negation, implication and bi- implication.	Explain the concepts of the essential connectives such as conjunction, disjunction, negation,	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Define the concepts; essential connectives, negation, conjunction, disjunction, implication and bi-implication.	Correct any error in the students' definitions and concepts.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
	1.2 Illustrate the essential connectives defined in 1.1 above 1.3 Describe grouping and parenthesis in logic 1.4 Explain Truth tables. 1.5 Define tautology. 1.6 Illustrate types of tautology. 1.7 Define universal quantifier and existential quantifier 1.8 Translate sentences into symbolic form using quantifiers. 1.9 Define the scope of a quantifier. 1.10 Define "bound" and "free" variables.	Illustrate the essential connectives define in 1.1 above; Describe grouping and parenthesis in logic; Explain and draws Truth tables for different combinations of propositions. Define and identify tautology. Illustrate types of tautology Use of quantifier in	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Describe grouping and parenthesis in logic. Draw truth tables Truth tables. Define and identify tautology. Illustrate types of tautology. Define universal quantifier and existential quantifier Translates some given sentences into symbolic form.	Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

		translating sentences into symbolic form; Explain the concept of bound and free variables.				

GENERAL OBJECTIVE 2.0: KNOW THE CONCEPT OF PERMUTATION AND COMBINATION						
5	2.1 Define permutation. 2.2 Give illustrative examples on permutation. 2.3 State and prove the fundamental principles of permutation and give examples. 2.4 Derive the formula $^{n}P_{r}=\frac{n!}{(n-r)!}$	Define and explains permutation. Give illustrative examples on permutation. State and prove the fundamental principles of permutation and give examples. Explain the derivation of the formula; $^{n}P_{r}=\frac{n!}{(n-r)!}$	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Define permutation. Solve some examples on permutation. State and prove the fundamental principles of permutation and solve further examples. Derive the formula $^{n}P_{r}=\frac{n!}{(n-r)!}$	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
7	2.1 Define combination and give illustrative examples. 2.2 Derive the formula $^{n}C_{r}=\frac{n!}{(n-r)!r!}$. 2.3 Solve problems of combination with restrictions on some of the objects. 2.4 Solve problems of combination of "n" different objects taken any number of it at a time.	Define combination and gives illustrative examples. Demonstrate the derivation of the formula $^{n}C_{r}=\frac{n!}{(n-r)!r!}$. Solve problems of combination with restrictions on some of the objects. Explain solution of problems of combination of "n" different objects taken any number of it at a time.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Define combination and give examples. Derive the formula $^{n}C_{r}=\frac{n!}{(n-r)!r!}$. Solve problems of combination with restrictions on some of the objects. Solve problems of combination of "n" different objects taken any number of it at a time.		Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

GENERAL OBJECTIVE 3.0: COMPUTE THE BINOMIAL EXPANSION OF ALGEBRAIC EXPRESSIONS						
8	3.1 Explain with illustrative examples, the method of Mathematical Induction. 3.2 State and prove binomial theorem for positive integer index.	Give detailed explanation with illustrative examples, the method of mathematical Induction. State binomial theorem and show the proof for positive integer index.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	State the method of Mathematical Induction. State and prove binomial theorem for positive integer index.	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
9	3.1 Describe with examples, the properties of binomial expansion.	State and explain with examples, the properties of binomial expansion.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	State the properties of binomial expansion.		Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
10	3.2 State the binomial theorem for a rational number. 3.3 State the properties of binomial coefficients.	State the binomial theorem for a rational number. State the properties of binomial coefficients.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	State the binomial theorem for a rational number. State the properties of binomial coefficients.		Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
11	3.5 Apply binomial expansion in approximations (simple examples only).	Demonstrate the application of binomial expansion in approximations (simple examples only).	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Apply binomial expansion in approximations (simple examples only).		Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

GENERAL OBJECTIVE 4.0: UNDERSTAND ALGEBRAIC OPERATIONS ON MATRICES AND DETERMINANT.						
12	4.1 Define Matrix. 4.2 Define the special matrices; zero matrix, identity matrix, square matrix, triangular matrix, symmetric matrix, skew-symmetric matrix, diagonal matrix, etc.	Define Matrix and explains the special matrices; zero matrix, identity matrix, square matrix, triangular matrix, symmetric matrix, skew-symmetric matrix, diagonal matrix, etc.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Define Matrix. Define the special matrices; zero matrix, identity matrix, square matrix, triangular matrix, symmetric matrix, skew-symmetric matrix, diagonal matrix, etc. State examples of each of the	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
13	4.3 State examples of each of the matrices in 4.2 above. 4.4 State the laws of addition and multiplication of matrices. 4.5 Illustrate the commutative, associative and distributive nature of the law stated in 4.4 above. 4.6 Define the transpose of a matrix. 4.7 Define the determinant, minors and cofactors of a matrix. 4.8 Determine the determinant, the minors and cofactors of 2x2 and 3x3 matrices.	Give examples of each of the matrices in 4.2 above. State the laws of addition and multiplication of matrices. Illustrate the commutative, associative and distributive nature of the law stated in 4.4 above. Define the transpose, the determinant, minors and cofactors of a matrix. Determine determinant, the minors and cofactors of 2x2 and 3x3 matrices.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	State the laws of addition and multiplication of matrices. Illustrate the commutative, associative and distributive nature of the law stated in 4.4 above. Define the transpose of a matrix. Define the determinant, minors and cofactors of a matrix. Determine the determinant, the minors and cofactors of 2x2 and 3x3 matrices.		

14-15	4.3 State and prove the theorem "that if two rows or two columns of a matrix are identical, then the value of its determinant is zero". 4.4 State and prove the theorem "that if two row or two columns of a matrix are interchanged, the sign of the value of its determinant is changed". 4.5 State and prove the theorem "if any one row or one column of a matrix is multiplies by a constant, the determinant itself is multiplied by the constant". 4.6 State and prove the theorem "if a constant times the element of a row or a column are added to the corresponding element of any other row or column, the value of the determinant itself is multiplied by the constant". 4.7 State five examples of each of the theorems in 4.9-4.12 above. 4.8 Obtain the adjoin of a matrix. 4.9 Obtain the inverse of a matrix. 4.10 State the linear transformation on the rows and columns of a matrix. 4.11 Apply Crammers rule in solving simultaneous linear equation. 4.12 Apply linear transformation in solving simultaneous linear equation.	Demonstrate the proof of the theorems given in 4.9-4.12. Use examples and verify each of the theorems referred to above. Guide the students in obtaining the adjoin of a matrix. Guide the students on obtaining the inverse of a matrix. Present the linear transformation on the rows and columns of a matrix. Demonstrate the application of Crammer's rule in solving simultaneous linear equation. Demonstrate the application of linear transformation in solving simultaneous linear equations.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Prove the theorems given in 4.9, 4.10, 4.11 and 4.12. Verify the theorems referred to in 4.9-4.12 above. Obtain the adjoin of a matrix. Obtain the inverse of a matrix. State the linear transformation on the rows and columns of a matrix. Apply Crammers rule in solving simultaneous linear equation. Apply linear transformation in solving simultaneous linear equation.		

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONA DIPLOMA INRAILWAY ENGINEERING TECHNOLOGY	**Course Code: MEC 112**	**Contact Hours: 1-0-3**
Subject/Course:Technical Drawing		**Theoretical: 1 hours/week**
Year:ND 1 Semester: 1	**Pre-requisite: -**	**Practical: 3 hours /week**

Goal: To enable students to acquire knowledge of Technical Drawing and apply same in solving problems in their areas of specialization.

General Objectives

1. Know different drawing instruments, equipment and materials used in technical drawing.
2. Know Graphical Communication.
3. Know the construction of simple geometrical figures and shapes.
4. Know Isometric and Oblique Projections.
5. Know single orthographic projections.
6. Understand the intersections of regular solids.

Course: Technical Drawing		Course Code: MEC 112		Contact Hours: 1-0-3		
				Theoretical: 1 hours/week		
	Year: One Semester: One	Pre-requisite: -		Practical: 3 hours /week		
	Theoretical Content		Practical Content			
Goal: To enable students to acquire knowledge of Technical Drawing and apply same in solving problems in their areas of specialization						
	General Objective 1: Know different drawing instruments, equipment and materials used in technical drawing.					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 – 2	1.1 Identify the different types of drawing instruments, equipment and materials. 1.2 State the uses of the various instruments, equipment and materials. 1.3 State the precautions necessary 1.4 Use each of the items in 1.1 above. 1.5 Maintain the various instruments and equipment.	• Show the students all drawing instruments: Drawing set; T-Square; Drawing board; Set squares; Types of pencils (H to B). • Explain the uses of drawing instruments.	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	Use each of the items in 1.1. Maintain the various instruments and equipment	Carryout the use of the items in 1.1. Carryout the maintenance of the various instruments and equipment.	Black board ruler (1m) Black board Tee-Square Black board compass Blackboard protector Adjustable set-square 60 set square 45 set square French curve set Templates Complete drawing table.

	General Objective 2: Know Graphical Communication					
	2.1 Explain graphics and different types of graphic presentation. 2.2 Illustrate the various convention present in graphical productions of construction lines, finished lines, hidden and overhead details projections, centre lines, break lines, dimensioning of plane, elevation and sections of objects. 2.3 State the various standards of drawing sheets. 2.4 Print letters and figures of various forms and characters. 2.5 Illustrate conventional signs, symbols and appropriate lettering characters.	▪ Explain technical lettering in capital and small letters, using, free hand and using letter stencils. ▪ Identify the various standard sheets A0 –A4	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic board, flip charts, etc.	Layout of drawing sheets with the following (a) Margins (b) Title block etc Illustrate in drawing the various types of lines based on BS 308 1972 Part 2. Set drawing area on A1 paper with a title block and the boarder lines. Draw conventional signs and symbols	Carryout layout of drawing sheets Carryout drawing of various types of lines based on BS 308 1972 Demonstrate drawing area on A1 paper with a title block and the boarder lines. Carryout drawing of conventional signs and	Black board ruler (1m) Black board Tee-Square Black board compass Blackboard protector Adjustable set-square 60 set square 45 set square French curve set Templates Complete drawing table

					symbols.	
	General Objective 3: Know the construction of simple geometrical figures and shapes.					
3 – 6	3.1 Explain the purpose of geometrical construction in wing.	▪ Discuss the various types of information required for writing technical report. ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
	General Objective 4: Know Isometric and Oblique Projections.					
7 - 10	4.1 Mention main sources of data. 4.2 Discuss techniques of data collection: • Laboratory. • Field survey/measurement. • Questionnaire. • Oral interviews.	▪ Guide student on techniques involved in sourcing data ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic board, flip	▪	▪	▪

			charts, etc.			
	General Objective 5: Know single orthographic projections.					
11 - 12	5.1 Explain how to present data in a manner suitable for writing technical report in the following form: Tables, Graphs, Charts, bars. 5.2 Input information into computer. 5.3 Print out results.	▪ Guide student on techniques involved in presenting information/ data ▪ Use questions and answer technique ▪ Give examples ▪ Give assignments	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.	▪	▪	▪
	General Objective 6: Understand the intersections of regular solids.					
13 - 15	6.1 Explain interpretation or intersections of solids. 6.2 Draw the lines of intersections of the following regular solids and planes in both first and third angles. a. Two square-prisms meeting at right angles. b. Two dissimilar square prisms meeting at an angle. c. Two dissimilar square prisms meeting to an	Ask students to give examples of intersection of solids Ask students to construct: a.Two square-prisms meeting at right angles b. Two dissimilar square prisms merely at " c. Two dissimilar	Recommended textbooks. Whiteboard, dust, Marker, lecture notes, drawing sets	▪	▪	▪

	angle d. A hexagonal prism meeting a square prism at right angles. e. Two dissimilar cylinders meeting at an angle. f. Two dissimilar cylinders meeting at right angle, their centres not being in the same vertical plane.	square prisms meeting 60 d. An hexagonal prism meeting a square prism e. Two dissimilar cylinders meeting at an anglef. Two dismal cylinders meeting at right angle, then centres at long in the same vertical place. g. As in 6.2				

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

Programme: NATIONAL DIPLOMA IN RAILWAY ENGINEERINGTECHNOLOGY	**Course Code: SUG 101**	**Credit Hours: 4**
Course: Basic Principles in Surveying I	**Pre-Requisite: - None**	**Theoretical: 1 Hours/Week**
Year : ND I Semester: 1		**Practical: 3 Hours/Week**

Goal: The course is designed to enable students acquire basic knowledge of Surveying and Geo-informatics

GENERAL OBJECTIVES

On completion of this course, the Student should be:

1.0 Understand the basic principles and scope of Surveying and Geo-informatics
2.0 Understand the use and methods of using linen and steel tapes in making linear measurements.
3.0 Understand the principles of measurement of angles with theodolites and bearing with a magnetic compass and perform such measurement.
4.0 Understand the basic principles and method of using total station and GPS equipment
5.0 Understand the principles of survey computations and plotting.
6.0 Know how to read, interpret and make measurements from maps, lay-out and engineering plans.

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERINGTECHNOLOGY						
COURSE: Basic Principles in Surveying I			**COURSE CODE: SUG 101**		**CONTACT HOURS: 4HRS**	
Goal: The course is designed to enable students acquire basic knowledge of Surveying and Geo-informatics						
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the basic principles and scope of Surveying and Geo-informatics.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
1-2	1.1 Explain the principles of working from 'whole to part' in Surveying and Geo-data works. 1.2 State the importance of "Scientific honesty" made on observations. 1.3 Explain with examples the various "checks" made on field observation and during computation. 1.4 Define errors of misclosure in surveys and describe methods of "balancing" these. 1.5 Explain the need and procedure for "examination" of Surveys and Geo-data. 1.6 Describe the various classes of Survey/ Geo-informatics and their order of accuracy. 1.7 Explain the Principles of 'Economy of accuracy"	Explain activities 1.1 to 1.11 to students	White board Projector Tape Theodolite Compass GPS	1.1 Carryout a measurement of linear distance of about 200m using linen tape: ! Surface Measurement ! Step Measurement. 1.2 Carryout a measurement of horizontal and vertical angles with theodolite and compass. 1.3 Carryout a map reading exercises – slope determination and direction, cross sections, contours, bearings, direction of river flows, and classification of features such as settlement, roads and rail lines. 1.4 Carryout compass survey and plot. 1.5 Carryout a demonstration of the use of a hand held GPS.	Guide students to conduct practicals	State the various classes of Survey/ Geo-informatics and their order of accuracy.

	and its influence on choice of equipment and methods. 1.8 Explain the principles of 'consistency' in Surveys/Geo-data. 1.9 Distinguish between accuracy and precision. 1.10 Describe the procedure of entrusting 'custody' of Survey/Geo-data monuments to local officials and the instructions for their 'preservation'. 1.11 Name the different branches of Surveying and Geo-informatics stating their aims e.g. geodetic survey, topographic survey, cadastral survey, hydrographic survey, engineering and large scale surveys.			.		

	General Objective: 2.0 Understand the use and methods of using linen and steel tapes in making linear measurements.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
3-6	2.1 Explain the effect of a. Misalignment b. Slope of using Linen c. Temperature d. Tension and e. Standardization error on measured distances in making linear. 2.2 Apply the corrections in making linear listed in 2.1 above measurement. 2.3 Identify chain surveying instruments e.g. Linen tapes, steel tapes, ranging rods. 2.4 State the necessary precaution in the use of above instruments. 2.5 State the criteria for selection in survey lines and offsets and the limitation lengths. 2.6 Describe the methods of making linear measurements in chain surveys – both limiting conditions on measurement accuracy. 2.7 Explain common errors of building corners, wrong booking values. 2.8 Explain with sketches the basic .methods of check or proof lines, and the use of control frame work for	Explain activities 2.1 to 2.16 to students	White board Projector Linen tapes Steel tapes Ranging rods	2.1 Identify chain surveying instruments e.g. Linen tapes, steel tapes, ranging rods. 2.2 Identify errors in simple chain surveys. 2.3 Carryout survey of an area of at least one hectare. 2.4 Draw to field standards using conventional signs and hand lettering.	Guide students to conduct practicals	Explain linear measurement and chain surveying

	position and orientation. 2.9 Describe the general procedure for carrying out a chain survey. 2.10 Illustrate the method of booking field measurements in chain surveys. 2.11 Enumerate field problems and methods of overcoming them. 2.12 Identify errors in simple chain surveys. 2.13 Carryout survey of an area of at least one hectare. 2.14 Book all field measurements. 2.15 Plot surveying at a suitable scale. 2.16 Draw to field standards using conventional signs and hand lettering.					

	General Objective: 3.0 Understand the principles of measurement of angles with theodolites and bearing with a magnetic compass and perform such measurement.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
7-8	3.1 Describe the various units of angular measure e.g. the principles grade and radian measures, working out their conversion factors. 3.2 Explain the working principles of a 'surveyor (Prismatic) compass. 3.3 Describe the procedure of observation with a 'surveyor' (Prismatic) compass. 3.4 Explain the method of theodolites. 3.5 Explain the difference in the reading procedure of a theodolite. 3.6 Carryout angular measurements with prismatic compass and theodolites.	Explain activities 3.1 to 3. 6 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite	3.1 Carryout angular measurements with prismatic compass and theodolites.	Guide students to conduct practical	Explain the working principles of a 'surveyor (Prismatic) compass.
	General Objective: 4.0 Understand the basic principles and method of using total station and GPS equipment.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
8-10	4.1 Describe a total station and its accessories. 4.2 Compare total station with a theodolite. 4.3 Explain the working principles of a total station.	Explain activities 4.1 to 4. 10 to students	White board Projector Linen tapes	4.1 Carry out a simple survey using a total station. 4.2 Retrieve the measured from total station field data on to a PC. 4.3 Process the data from the	Guide students to conduct practicals	Explain the working principles of a total station

	4.4 Describe the procedures of observation with a total station. 4.5 Carry out a simple survey using a total station. 4.6 Retrieve the measured from total station field data on to a PC. 4.7 Process the data from the PC. 4.8 Plot the plan of the surveyed area manually. 4.9 Describe the various types of GPS equipment e.g. hand held and tripod types. 4.10 Explain the working observations on selected points.		Steel tapes Ranging rods Prismatic compass Theodolite Total station GPS Computers	PC. 4.4 Plot the plan of the surveyed area manually		
	General Objective: 5.0 Understand the principles of survey computations and plotting.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
11-12	5.1 Reduce the measured field data with a theodolite to obtain required angles. 5.2 Deduce bearings from the obtained angles. 5.3 Carryout traverse computation to obtain coordinates. 5.4 Carryout traverse computation adjustment to obtain corrected (final) coordinates. 5.5 Adjust compass bearings of the compass surveyed area. 5.6 Carryout the computation	Explain activities 5.1 to 5. 9 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station	5.1 Carryout traverse computation to obtain coordinates. 5.2 Carryout traverse computation adjustment to obtain corrected (final) coordinates. 5.3 Adjust compass bearings of the compass surveyed area. 5.4 Adjust compass bearings of the compass surveyed area. 5.5 Retrieve the measured field data of the surveyed area by a total station	Guide students to conduct practicals	State the principles of surveying computations and plotting

	5.5 above. 5.7 Retrieve the measured field data of the surveyed area by a total station onto a PC. 5.8 Process the data using the PC. 5.9 Plot the plan of the surveyed area manually at different scales (small, medium and large).		GPS Computers	onto a PC. 5.6 Plot the plan of the surveyed area manually at different scales (small, medium and large).		
	General Objective: 6.0 Know how to read, interpret and make measurements from maps, lay-out and engineering plans.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
13-15	6.1 State the use of different types of map e.g. topographical, engineering and guide maps. 6.2 Explain the principles of map scale. 6.3 State the relationships between map scales or representative fractions and the contour interval. 6.4 Identify map symbols and conventional signs. 6.5 Explain their basis and use. 6.6 Identify various Nigerian map series. 6.7 Use map catalogues. 6.8 Describe various method of showing relief on maps e.g. spot heights, hachures, contours.	Explain activities 6.1 to 6. 19 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station GPS Computers	6.1 Identify map symbols and conventional signs. 6.2 Identify various Nigerian map series. 6.3 Interpret different types of map, layout plans and diagrams/sketches 6.4 Identify simple planimetric details on imageries. 6.5 Measure distances from curves from given diagram. 6.6 Determine radius of curves from given diagram. 6.7 Read off direction/bearing between given features.		Explain the principles of map scale.

	6.9 Define map grids. 6.10 Use map grids. 6.11 Explain how to establish different reference directions e.g. true north, grid north and magnetic north. 6.12 Define the relationship between the different direction i.e. convergence, declination and compass variation. 6.13 Scale off grid coordinates. 6.14 Interpret different types of map, layout plans and diagrams/sketches. 6.15 Identify simple planimetric details on imageries. 6.16 Measure distances from curves from given diagram. 6.17 Determine radius of curves from given diagram. 6.18 Read off direction/bearing between given features. 6.19 Describe different map reference systems.		Maps			

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

Programme: NATIONAL DIPLOMA IN RAILWAY ENGINEERINGTECHNOLOGY	**Course Code: CEC 108**	**Credit Hours: 5**
Course: Engineering Geology and Basic Soil Mechanics	**Pre-Requisite: - None**	**Theoretical: 2 Hours/Week**
Year : ND I Semester: 1		**Practical: 3 Hours/Week**
Goal: The course is designed to enable students acquire basic knowledge of Engineering Geology and Basic Soil Mechanics		
GENERAL OBJECTIVES		
On completion of this course, the Student should be: **1.0** Know the nature and composition of the earth crust. **2.0** Know all aspects of structural geology. **3.0** Understand geological surface processes**.** **4.0** Understand principal geological factors affecting some engineering projects **5.0** Know about soil mechanics, its applications ad classifications in Civil Engineering **6.0** Know about surface drainage and groundwater lowering **7.0** Know the principle of neutral and effective stresses. **8.0** Understand the crystal formation of soils using clay mineralogy		

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERINGTECHNOLOGY						
COURSE: Engineering Geology and Basic Soil Mechanics			**COURSE CODE: CEC 108**			**CONTACT HOURS: 5HRS**
Goal: The course is designed to enable students acquire basic knowledge of Engineering Geology and Basic Soil Mechanics						
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know the nature and composition of the earth crust.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
1-3	1.1 Define geology. 1.2 Explain the geological formation etc the earth. 1.3 State the 3 different types of rocks. 1.4 Explain the formation of the 3 different types of rooks. 1.5 Explain the physical characteristics of minerals. 1.6 Describe the chemical composition of rocks. 1.7 Identify the petrological characteristics of igneous rocks 1.8 Explain the formation of sedimentary rocks. 1.9 Describe fully the different types of erosion 1.10 Describe all forms of soil deposit 1.11 Explain earthquakes, isostacy, ocean floor and continental drift, modern plate tectonics.	Explain activities 1.1 to 1.11 to students	White board Projector Rock Specimens	1.1 Identify the petrological characteristics of igneous rocks	Guide students to conduct practical	Explain the formation of the 3 different types of rooks.

	General Objective: 2.0 Know all aspects of structural geology.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
4-5	2.1 Explain the different structural aspects of geology (strike, joints, cleavage, dip, fold, fault, land slides and thrust). 2.2 Describe the relationship between strata and outcrops. 2.3 Interpretation of geological maps. 2.4 Produce dips and strikes from geological maps.	Explain activities 2.1 to 2.4 to students	White board Projector Samples Geological Maps	2.1 Interpret geological maps. 2.2 Produce dips and strikes from geological maps 2.3 Identify various rocks, soils, and minerals and structural aspects of geology.	Guide students to conduct practicals	State the relationship between strata and outcrops.
	General Objective: 3.0 Understand geological surface processes.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
6-7	3.1 Describe the agents of denudation and other types of weathering 3.2 Describe product of denudation.	Explain activities 3.1 to 3. 2to students	White board Projector	-	-	State the products of denudation

	General Objective: 4.0 Understand principal geological factors affecting some engineering projects					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
8-9	4.1 Describe the geological factors affecting stability of slopes' cuttings and embankments. 4.2 Mention geological conditions affecting impounded surface water (reservoir and dam sites). 4.3 Describe geological consideration in tunneling drilling, and foundations.	Explain activities 4.1 to 4. 3 to students	White board Projector	-	-	State geological conditions affecting impounded surface water (reservoir and dam sites).
	General Objective: 5.0 Know about soil mechanics, its applications ad classifications in Civil Engineering					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
10-11	5.1 Define soil mechanics. 5.2 Differentiate between engineering soil and other soil types. 5.3 Explain the role of soils in Civil Engineering. 5.4 Explain the different types of soil 5.5 Explain classification of soil. 5.6 Explain classification by Grain Size and M.I.T/ Consistency method. 5.7 Describe in detail the properties of soil aggregates (Void Ratio Porosity, Moisture, etc.).	Explain activities 5.1 to 5. 9 to students	White board Projector Samples, specific gravity bottles, sieves, atterberg limit apparatus, tray, oven etc	5.1 Perform soil classification tests, e.g., identification, specific gravity, sieve analysis, consistency limits. 5.2 Carry out water content and specific gravity experiments on solids 5.3 Carry out grain size analysis using the manual and mechanical methods.	Guide students to conduct practicals	Explain classification of soil.

	5.8 Work test examples of above. 5.9 Perform soil classification tests, e.g., identification, specific gravity, sieve analysis, consistency limits.					
	General Objective: 6.0 Know about surface drainage and groundwater lowering					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
12	6.1 Describe surface drainage and wells. 6.2 Explain the method of lower in water in ground and wells. 6.3 Solve problems on all the above.	Explain activities 6.1 to 6. 3 to students	White board Projector	-	-	Describe surface drainage and wells.
	General Objective: 7.0 Know the principle of neutral and effective stresses.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
13	7.1 Use Piston and Spring analogy to substantiate neutral and effective stresses. 7.2 Sketch stress distribution in soils under concentrated and distributed load.	Explain activities 7.1 to 7. 2 to students	White board Projector	-	-	State the principles of neutral and effective stresses.

	General Objective: 8.0 Understand the crystal formation of soils using clay mineralogy					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
14-15	8.1 Describe basic building units of clays. 8.2 Describe tetra- and Octa-building arrangements. 8.1 Explain the formation of two-layer soils with typical example like Kaolinite 8.2 Explain the formation of three – layer soils with typical example like montmorilloride. 8.3 Describe the soil chain. 8.4 Relate knowledge of clay mineralogy to Nigerian soils, e.g. Laterites etc. 8.5 Explain applications.	Explain activities 8.1 to 8. 5 to students	White board Projector	-	-	Explain the formation of two-layer soils with typical example like Kaolinite

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY	**COURSE CODE: ICT 101**	**UNIT: 4**	**TOTAL CONTACT HOURS: 4**
COURSE TITLE: Introduction to Computing			**THEORETICAL:1Hours/Week**
YEAR : ND I SEMESTER: 1	**Pre-requisite: -**		**PRACTICAL:3 Hours/Week**
GOAL: This course is designed to develop the student's understanding and application of general principle of Computing			
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the basic components of the computer and how it has evolved 2.0 Know how data is stored and applications of various operating systems 3.0 Understand the operation of Windows operating system and application packages 4.0 Understand file Management and software package			

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY		COURSE CODE:ICT 101		UNIT: 4		TOTAL CONTACT HOURS: 4 HRS/WEEK
COURSE TITTLE: **Introduction to Computing**						THEORETICAL: 1 HOURS/WEEK
SEMESTER 1		PRE-REQUISITE:-				PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to develop the student's understanding and application of general principle of Computing						
GENRAL OBJECTIVE 1.0: Understand the basic components of the computer and how it has evolved						
THEORETICAL CONTENTS				**PRACTICAL CONTENTS**		
WEEK/S	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1-3	1.1 Define what is meant by a computer 1.2 Explain briefly the history of computer development. 1.3 State the uses of computer and understand the impact of the PC on computer technology 1.4 Differentiate between hardware and software 1.5 Explain the input-processoutput algorithm with the following in mind: -Central processor -Input Mechanism -Output Mechanism	Relate the present idea of computer to other equipment and items that assess man to perform tasks faster Trace the historical evolution of Computers Assess the impact of computers to every day living Conduct the students through the various parts of the computer and how data is managed by the various parts in the system	Maximum of 4 students to a Computer system Maximum of 4 computers to a printer except when a Network is in use Papers and computer accessories Magic Board Multimedia projector system			
GENERAL OBJECTIVE 2.0 Know how data is stored and applications of various operating systems						
4-6	2.1 Understand the application of the following: • RAM • ROM • Fixed discs • Removable • 2.2 Understand the concept of an operating system i. PC-	Explain the need for data storage Dismantle a computer system and show the students the RAW card, the Hard disk and the processors Explain the concept of an operating system	Instructional materials Flip charts Projectors Video Internet			

	DOS/MS DOS ii. Windows iii. Linux iv. Unix					
GENERAL OBJECTIVE 3.0: Understand the operation of Windows operating system and application packages						
7-11	3.1 Access computers correctly through Windows Operation system 3.2 Understand the steps for opening and closing windows 3.3 Understand the application of program Manager 4.4 know the uses and application of the various windows bars 3.5 Understand how to move from one window to another and how to operate them concurrently 3.5 Understand file management and how to mange files 3.6 Know the step in creating files and folders 3.7 Understand file manipulation(moving copying saving deleting etc) 3.8 Understand the use of Print Manager 3.9 Understand the concept of the following software package • MS Office • Lotus Smart suite • MS Encarta	Discuss the advantage of Windows Operating System Explain the Windows Menu and tools. Each student must be given an opportunity to start a computer, open/close the window operating system, understand the program manager and move around in the windows environment Explain the process of creating a file, manipulating the file and use of the print manager Assess the student Load MS Office with the student and explain the various packages that make up MS office. Load MS Encarta and discuss its use with the student Assess the student	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 4.0: Understand file Management and software package						
12-15	4.1 Demonstrate ability in the use of a word processing packages such as MS Word or Word Perfect and covering the following: -Entering text	Demonstrate the installation of MS Word Identify the different features of the software	Instructional materials Flip charts Projectors Video Internet			

	-Formating text (emboldening,, font size, italising, etc) - Creating and saving text files - Importing objects 9. Spelling and grammar checking - Creating and manipulating tables, text boxes equations - Printing and file export	Ask students to type a short document and save it Ask students to edit a document and carry out a spell check Demonstrate the use of tables				

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: PRINCIPLES OF RAILWAY ENGINEERING AND OPERATIONS	**COURSE CODE:** RWE 111	**CREDIT UNIT: 3**	**CONTACT HOURS: 3HOURS/WEEK**
YEAR : ND I			**THEORETICAL: 2HOUR/WEEK**
SEMESTER: 1	**PRE-REQUISITE : NONE**		**PRACTICAL:1 HOURS/WEEK**

Goal: The course is designed to enable students acquire basic knowledge of Railway Engineering and Operations.

General Objectives:

On completion of this course; the student should be able to:

1.0 Know the organizational structures of a Railway systems operation

2.0 Understand the various Railway operations

3.0 Understand the effect of weather on Railway operations

4.0 Understand the types and various components of Railway Track

5.0 Understand the key aspects of Rail vehicle dynamics and the wheel-Rail interface

6.0 Understand Railway Timetabling process.

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: PRINCIPLES OF RAILWAY ENGINEERING AND OPERATION			**COURSE CODE**: RWE 111		**CONTACT HOURS**: 3HOURS	
GOAL: The course is designed to enable student acquire basic knowledge of Railway Engineering and operations						
COURSE SPECIFICATION: **THEORETICAL CONTENT**				COURSE SPECIFICATION: **PRACTICAL CONTENT**		
Week	***Specific Learning Outcomes***	***Teacher's Activities***	***Learning Resources***	***Specific Learning outcomes***	***Teacher's Activities***	***Evaluation***
	GENERAL OBJECTIVE 1.0 Know the organizational structure of a Railway System.					
1-3	1.1 Define Railway. 1.2 Explain Railway Engineering. 1.3 Explain the History and development of Railway Technology. 1.4 State Rail Transportation Establishment Act. 1.5 Identify various Railway Operational departments.	Explain activities 1.1 and 1.2. Explain the History and development of railways.. Explain the History and development of railwaysin Nigeria. Compare the History and development of Railwaysin Nigeria to other parts of the world such as Uk, China, Russia, India, etc. Explain the Nigerian Railway Establishment Act Sketch the structure of the NigerianRailway corperation	Marker Board/Smart Board. Video clips Projector Computers Model of various Railway components. Video clips of the various components of a railway sysytem	Identify various componentsof the Railway.	Guide students using chart, learning aid to carry out the practical	Explain the organizational structure of a Railway System.

GENERAL OBJECTIVE 2.0 Understand the various Railway Operations						
4-6	2.1 Explain Rail Traffic Operations: • Signalling • Time table planning • Service provision 2.2 Explain Railway commercial operations: • Mass Transportation • Freight & Haulage operation • Station and Depot operation • Rail Market operation 2.3 Explain the various Engineering operations in Railway systems: • Track and Infrastructure development • Electrification and Communication development • Rail vehicle development • Railway Energy and supply 2.4 Explain basic safety procedures in Railway operations.	Explain activities 2.1 to 2.4	White Board Projector Video clip Traffic signs Red flags Yellow & Black flags Video clips of the various Railway Operations	Identify and interpret the various Railway signals used in traffic operations. Conduct an excursion visit to a typical railway infrastructure to observe commercial operations/ Decumentaryonrial infrastructure operations	Organize site visit to a railway station	State various Railway Operations

GENERAL OBJECTIVE 3.0 Understand the effect of weather in Railway Operations						
7-8	3.1 List weather forecast equipment. 3.2 Explain the functions of thevarious weather forecast equipment listed in 3.1. 3.3 Explain the role of Weather forecast in Railway Operations.	Explain activities 3.1 to 3.3	White Board Projector Complete Weather station.	Identify weather forecast equipment Record weather data using various equipment	Demonstrate how readings are recorded using the various equipment	State the effect of weather in Railway Operations.
GENERAL OBJECTIVE 4.0 Understand the types and various components of Railway Track						
9-10	4.1 Explain the general profile of Rail Track 4.2 Explain the various gauges of Rail Track 4.3 Explain the operation of single, doubles and multiple Track Railway	Explain activities 4.1 to 4.3 to students	White Board Projector Video clip	-	-	Explain the operation of single, doubles and multiple Track Railway.
GENERAL OBJECTIVE 5.0 Understand the key aspect of Rail vehicle dynamics and the wheel –Rail Interface.						
11-13	5.1 Explain static and dynamic friction 5.2 Explain dead load and live load	Explain activities 5.1 to 5.4	White Board Projector Video tape	-	-	Explain static and dynamic friction.

	5.3 Explain the various types of Forces acting on the wheel and Rail interface 5.4 Explain the various types of wear of the wheel & Rail Interface					
GENERAL OBJECTIVE 6.0 Understand Railway Timetabling process						
14-15	6.1 Explain Timetabling in Railway Operations 6.2 List the factors needed to develop Railway Timetable	Explain 6.1 to 6.2	White marker Board Projector Video clip	-	-	Explain timetabling in Railway Operations

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Assignment	At least Two (2) assignment to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: RAILWAY WORKSHOP THEORY & PRACTICE	**COURSE CODE: RWE 112**	**UNIT: 3**	**CONTACT HOURS: 4HOURS/WEEK**
YEAR : 1 SEMESTER: 1	**PRE-REQUISITE : NONE**		**PRACTICAL:2HOURS/WEEK**

Goal: The course is designed to enable the student to understand the use of basic workshop tools and machines, and the hazards in a railway and related environment.

General Objectives:

On completion of this module, the students should be able to:

1. 0 Know safety precautions.

2.0 Understand accident reporting and investigation

3.0 Understand noise pollution and control

4. 0 Understand to use and maintain various bench tools.

5. 0 Understand the Use of simple measuring and testing equipment.

6. 0 Understand drilling Operations

7. 0 Understand reaming operations.

8. 0 Understand Tapping Operations

9. 0 Know various metals joining operation.

10. 0 Know various gas welding operations.

11. 0 Know various metal arc welding operations

12. 0 Understand Brick and Plumbing Work

COURSE TITLE: RAILWAY WORKSHOP THEORY & PRACTICE		COURSE CODE: RWE 112		UNIT: 3		CONTACT HOURS: 4HRS/WEEKS
						THEORETICAL: 2HOURS/ WEEK
YEAR : 1 SEMESTER : 1		PRE-REQUISITE : None				PRACTICAL: 2HOUR/ WEEK
Goals: The course is designed to enable the student to understand the use of basic workshop tools and machines, and the hazards in a railway and related environment.						
	GENERAL OBJECTIVE 1.0: Know Safety precautions.					
	THEORETICAL CONTENT			**PRACTICAL CONTENT**		
WEEK/S	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITY	RESOURCE	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITY	EVALUATION
1	1.1 State safety precautions. 1.2 Explain protective wears. 1.3 List all safety rules and regulation. 1.4 Explain the main provisions of the health and safety act at work. 1.5 Explain the main provisions of the Factories Act Fire Precautions. 1.6 State the relevance of Common Law to health and safety at work. 1.7 Explain the general duties in respect of health and safety of employers and employees and others in work places, etc	Discuss safety precautions observed in the workshop. List the protective wears in the workshop. Discuss safety rules in the workshop Outline the provisions of the health and safety act at work place. State the relevance of common law to health and safety at work. Narrate the general duties in respect of health and safety of employers and others in control of work places, employees, suppliers, etc.	White and magnetic board, Projectors. overalls, aprons, safety goggles, safety boots/shoes, safety hand gloves, fire extinguishers, nose masks, ear muffs, hard hats, non-slip mats, safety posters, Water hose and Sand buckets	Demonstrate safety precautions. Operate safety equipment e.g. fire extinguishers, Use of protective wears Observe all safety rules and regulations	Discuss some unsafe acts and condition in the workshop. Demonstrate the safety protective wears and equipment.	Explain the main provisions of the health and safety act at work.

	General Objective 2.0 Understand accident reporting and investigation					
2	2.1 Classify accidents. 2.2 State the procedure for reporting accidents to appropriate authorities. 2.3 List the main elements of oral and written reports of accidents and their purpose. 2.4 Use the reports of accidents in generating statistical data for prevention and control of accident (e.g. frequency rate).	Classify accidents. State the procedure for reporting accidents. List the main elements of oral and written reports of accidents and their purposes.	Instructional Manual. Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, incident report book etc.	-	-	State the procedure for reporting accidents to appropriate authorities.
	General Objective 3.0 Understand noise pollution and control					
3	3.1 Define noise pollution 3.2 State sources of noise pollution. 3.3 Explain the allowable limits of noise pollution for different areas. 3.4 Explain the problems of noise pollution and measures to control them. 3.5 Explain noise pollution control devices.	Explain 3.1-3.5.	Instructional Manual. Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc. Sound level meter Noise Dosimeter	Determine sound pollution in: • Classroom. • Busy roads • Factory	Guide student to conduct the practical.	State sources of noise pollution.

	General Objective 4.0: Understand to use and maintain various bench tools.					
4	4.1 Explain bench work and fittings. 4.2 Describe the classification of fitting tools 4.3Define Marking out tools 4.4 Explain the tools use for marking out 4.5 Differentiate between Hand and power tools	Explain bench work and fittings as used in the workshop.	Recommended textbook, Markers, White and magnetic board, Projectors Dusters, Work bench, Bench vice, Hammers, Set of drills, Steel rule, Scribers, callipers, gauges, Surface plate Dividers, punches, Files, Chisels, Scrapers, Hack saw.	Use marking-out tools on the bench correctly Produce simple objects using bench/hand tools such as files, chisels, scrapers, saws etc. Maintain files, dividers, saws, gauges, try squares, bevel edge square etc.	Demonstrate the differences between Hand tools and power tools List out marking out tools used on the bench typical workshop practical exercises. Explain the use of these tools and their care	Explain bench work and fittings

	General Objective 5.0: Understand the use of simple measuring and testing equipment.					
5	5.1 Explain the classification of measurement. 5.2 Describe the tools used in 5.1 5.3 Highlight the differences between measurement and dimensions. 5.4 Know how to read the Vernier caliper and micrometer screw gauge.	Describe the measuring equipment used in the workshop.	Recommended textbooks, Markers, Dusters, White and magnetic board, Projectors, videos, diagram pictures, Micrometers - Vernier callipers, screw gauge, Steel rule	Perform simple measuring exercises using steel rules, Vernier callipers and micrometers. Carry out exercises involving flatness squareness, straightness and surface finish test. Perform taper measurement on jobs using Vernier protractor and sine bars. Inspect jobs using simple comparators	Differentiate between measuring and testing in the workshop. Demonstrate on the use of measuring instruments	Explain the classification of measurement.

	General Objective: 6.0: Understand Drilling Operation.					
6	6.1 Describe drilling operations 6.2 Discuss the nomenclature of a twist drill 6.3 Explain the types of drilling machine. 6.5 Mention all operations to be carried out using drilling machine.	Calculate the speeds of various sizes of drills using appropriate formulae n = v x 1000/[p x d] v = cutting speed d = diameter of drill in (mm) n = no. of revs/min. Explain the nomenclature of a twist drill. clearance angle, rake angle, point angle etc.	Multimedia, White and magnetic board, Projectors, videos, diagram pictures, markers, recommended textbooks. Radial drilling machine ,Bench drilling machine, Pillar drilling machine ,Column type drilling machine.	Demonstrate the Operation of different types of drilling machine .	Differentiate between drilling and boring operations Demonstrate the nomenclature of a twist drill. a. clearance angle b. rake angle c. point angle etc. Calculate the speeds of various sizes of drills using appropriate formulae n = v x 1000/[p x d] v = cutting speed d = diameter of drill in (mm) n = no. of revs/min.	Describe drilling operations

	General Objective: 7.0: Understand Reaming Operations.					
7	7.1 Describe reaming operations 7.2 Explain the steps necessary for reaming operations	Differentiate between drilling and reaming in the workshop.	Recommended textbook, White and magnetic board, Projectors, videos, diagram pictures. Hand reamers Machine reamers Tap wrench, Jacobs chuck and key Medium size Lathe	Carry out reaming operations:- i. on the bench ii. On drilling/lathe Select correct speeds for reaming small and large holes.	Demonstrate to the students to do reaming operation on a practical workshop exercise. Drill, ream small; and large holes using correct speeds and feed and appropriate lubricants.	Explain the steps necessary for reaming operations
	General Objective: 8.0: Understand Tapping Operation.					
8	8.1 Define tapping operations 8.2 Describe the types and forms of tapping operations.	Differentiate between tapping, drilling and reaming in the workshop	White and magnetic board, Projectors, videos, diagram pictures, recommended textbooks. Taps and wrenches, Drill chuck and key Lathe machine, medium size _ Bench drilling machine, Pillar drilling machine Cutting fluid or lubricants	Select correct tapping drill size Select correct taps Carry out tapping operation (i) on the work bench (ii) on drilling (iii) on lathe machine	Demonstrate the purpose of tapping operation Calculate tapping drill size using appropriate formulae Demonstrate how taps are characterized a. pitch of the thread b. number of starts c. profile of the thread d. direction of the thread	Describe the types and forms of tapping operations.

	General Objective: 9.0: Know Various Metals Joining Operations.					
9-10	9.1 Define metal joining 9.2 Describe the types of metal joining 9.3 State all the conditions necessary for metal joining. 9.4 Explain how to correct taps 9.5 Explain out soft soldering.	Discuss the various metal joining methods Distinguish between soldering and brazing Discuss the importance of using flux. Explain the various forms of metal joining Bolts and nuts, spanner, bending machine, hammer, cutting snips or hand shears.	Recommended textbooks, White and magnetic board,.	Fabricate metal container by Knock-up joining Join metals by the grooving technique Carry out soft soldering	Demonstrate to the students the various metal joining operations Fabricate metal container by Knock-up joining Join metals by grooving technique. Show the correct tapping drill size	State all the conditions necessary for metal joining.
	General Objective 10.0 Know Various gas Welding Operations.					
11	10.1 Describe Gas welding operations 10.2 Explain the components of oxy-acetylene gas welding	List out all the component parts of an oxy-acetylene welding plant and identify them.	Recommended textbooks, White and magnetic board,. Blow lamps Soldering iron Soldering flux Safety welding goggles Oxygen gas cylinder Acetylene gas cylinder	Fabricate metal container by Knock-up joining Join metals by the grooving technique Carry out soft soldering	Demonstrate the various metal joining operations Fabricate metal container by Knock-up joining Join metals by grooving technique.	Explain the components of oxy-acetylene gas welding

			Regulators, clips, nozzles Hoses, flash gas lighter Welding nozzles Gas welding set Chipping hammer Wire brush ,Flame cutting blow pipe (nozzle)			
	General Objective: 11.0: Know Various Arc Welding Operations.					
12-13	11.1 Describe arc welding 11.2 List the types of welded joint 11.3 State the polarity of arc welding. 11.4 list metal arc welding equipment. 11.5 Explain the following: (i) metallic inert-gas arc-welding (ii) Carbon Arc-Welding (iii)Submerged Arc-Welding	Explain various welding techniques	Recommended textbooks, White and magnetic board, Electric arc welding Machine, Face shield, Welding table, Welding chipping, hammer, Wire brush, Hand gloves, Leather apron's, Hand grinder , Pedestal grinding machine	Regulate current and determine polarity for metal arc welding Determine polarity and select current Perform various arc-welding joints by down and up operation. Select and prepare metal edges for various thickness and technique welding	Distinguish between down welding and up welding operation Demonstrate the Performance of down and up welding operation Prepare appropriate metal edges for various metal thickness	List the types of welded joint
	General Objective 12.0. . Understand Brick and Plumbing Work					
14-15	12.1 Explain how to set out a simple railway track foundation and super structure. 12.2 Execute foundation trench and cast concrete. 12.3 Set out a simple railway drainage wall super	Explain activities 12.1to 12.5 to students.	Recommended textbooks, White and magnetic board. Pegs, nails, line, angles, tapes, wooden rails, optical square, compass and other survey equipment Spades, diggers,	Prepare site plan. Execute foundation trench and cast concrete.	Supervise the execution of simple railway track foundation and super structure. Demonstrate execution procedure and blinding.	Explain how to set out a simple railway track foundation and super structure

	structure 12.4 Describe the installation of simple railway plumbing work 12.5 Separate pipes for waste water		Shovels, Wheelbarrows, Plumbs level, dumping level, raging staff, rods, measuring tapes, concrete mixer, batching boxes. Sandcrete blocks, Cement, sand, crush aggregates, water, trowel, float, square, spirit level. Plastic copper and GI pipes including their elbows, beads, joints and valves yarn and putty, pipe wrench, pipe standing mobile vice mounted on a tripod, measuring tape and adhesives. Pipes, blocks, yarning, Pipe range, threading , Machine, gums,	. Demonstrate laying and bound for hollow blocks filled with plain concrete Perform simple plumbing installation. Separate pipes for waste water	Supervise foundation construction Demonstrate simple plumbing installation. Demonstrate the plumbing for waste water. Demonstrate the plumbing for waste water	

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Assignment	At least Two (2) assignment to be assessed by the teacher	20
Total		100

ND I SEMESTER TWO

COURSE: CITIZENSHIP EDUCATION II	COURSE CODE:GNS 121	UNIT:2	CREDIT HOURS: 2

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY	Course Code: GNS 121	UNIT: 2	Total Contact Hours: 2
COURSE TITLE: CITIZENSHIP EDUCATION II			Theoretical: 2 hours/week
Year : ND 1 Semester: 2	Pre-requisite: -		Practical: 0 hours/week

Goal: The Course is designed to enable Student to acquire knowledge of arms of government, political parties, constituted authority, national ethics, national identity as well as methods of environmental protection.

General Objectives: On the completion of the course, the students should:

1.0 Understand Government, political parties and election
2.0 Know the arms of Government
3.0 Understand Constituted Authority
4.0 Understand national identity
5.0 Understand national ethics and discipline in national life
6.0 Know some methods of environmental protection

	THEORETICAL CONTENTS			PRACTICAL CONTENT S		
	Goal: The Course is designed to enable Student to acquire knowledge of arms of government, political parties, constituted authority , national ethics, national identity as well as methods of environmental protection.					
	GENERAL OBJECTIVE 1.0: Understand Government					
WEEK /S	**SPECIFIC LEARNING OUTCOME**	**TEACHER ACTIVITIES**	**RESOURCE**	**SPECIFIC LEARNING OUTCOME**	**TEACHER ACTIVITIES**	**RESOURCE**
1-2	1.1 Define government 1.2 Outline the functions Of government 1.3 Explain the need for Government 1.4 Describe the following Forms of government i. Presidential ii. Parliamentary iii. Monarchical iv. Republican v. Federal	Define the term Government and indicate the three major organs of government. State and explain the basic functions of government to its citizens and list the reasons why the citizens of a state need government. List the various types of government and explain their advantages and disadvantages Explain the roles of the i. President ii. Prime minister iii. Opposition party iv. Collective bargaining	The 1999 constitution of Fed Republic of Nigeria Prescribed texts books The white board	Draw a diagrams explaining the i. Presidential ii. Parliament iii. Monarchy government (1) Mention types of government that operates in Nigeria.	Lead a discussion on government Ask the students to explain at least one type of government	The 1999 constitution of Fed Republic of Nigeria Prescribed texts books
GENERAL OBJECTIVE 2.0: Having General Knowledge Of Electoral System Or Processes Of Election						
3-4	2.1 Define Election 2.2 Explain features of Electoral system 2.3 Outline types of Election 2.4 Assess the advantages and disadvantages of each type of elections 2.5 Problems of Election in Nigeria 2.+ How to conduct a free and fair election	Explain the term election. State the basic Features of electoral system List the various types of election and explain the advantages and disadvantages of each type of elections. Identify the problems	White board and Prescribed texts	Mention the Types of election that we have in Nigeria and Identify the Problems that Is associated With election ii. Outline ways we should conduct a free and fair election	Explain how to conduct a free and fair election for an association or country.	The constitution, picture of a ballot box and paper.

		of an election and state method to conduct a free and fair election.				

GENERAL OBJECTIVE 3.0: Having A General Knowledge of Politics And Political Parties						
5-7	3.1 Define political parties 3.2 Explain types of political Parties. 3.3 Explain the functions of other agencies in election Define pressure group. 3.4 Highlight methods used by Pressure group in influencing Government policies. 3.5 Discuss types of pressure group 3.6 Highlight functions of pressure Groups and public opinion.	Explain political parties List the various parties that we have in Nigeria Defined pressure group Lead a discussion on the Different methods that Pressure group adopt to Influence government Policies. State the functions of Pressure group and Public opinions Mentions the differences between pressure group and political parties.	White board Card board	Define political Parties and pressure group Mention the difference Between political Parties and Pressure group Mention the Method that Pressure group adopt to influence Government policies	List the major functions of Political parties and Pressure groups	Drawing showing different Political parties and their symbols A chart showing difference betwee Political parties a Pressure groups.

	GENERAL OBJECTIVE 4.0: HAVING A GENERAL KNOWLEDGE OF CONFLICT, TYPES AND STAGES OF CONFLICT					
8-97	4.1 Define conflict 4.2 Explain stages of conflict 4.3 Enumerate types of conflict 4.4 Outline conflict management strategies.	Guide the students to understand the meaning of conflict. State the different stages of conflict pointing out how they affect growth of the organization Explain types of conflict List the various ways that individuals or organizations can manage conflict	Prescribed Textbook white Board	Define conflict Outline difference types of conflict. Mentions various ways that individuals or organizations can manage conflict Discuss the different stages of conflict	Discuss conflict management	Drawing of diagram that explains the Different stages o Conflict

	General Objective 5.0: Having a General Knowledge of National Ethics					
10-11	5.1 Explain the need for national ethics 5.2 Relate various aspects of National ethics to national Development 5.3 Discuss the causes and Consequences of indiscipline in the nation. 5.4 Evaluate the methods used by public agencies in the control of indiscipline 5.5 Discuss how a citizen can participate in the control of Indiscipline. 5.6 Discuss the need to maintain the right attitude toward Public property.	Explain the reason why we need national ethics List the various causes of Indiscipline in a nation State the methods used by public agencies to Control indiscipline in Nigeria. Guide the students to understand the areas in which the citizens can help in the control of indiscipline. Emphasize on the need to maintain the right attitude to public property.	National Orientation chart.	List and explain the different types of misconduct and their causes. List the causes of indiscipline in Nigeria and what should be done to stop them.	State the importance ethics in the society. Lead a discussion on the causes and remed of indiscipline.	National Orientation chart.

	General Objective 6.0: Having a General Knowledge of National Ethics					
12--15	6.1 Define national orientation 6.2 Explain the purpose for National orientation. 6.3 Enumerate the benefits of National orientation 6.4 Highlight the challenges of National orientation 6.5 List the Agencies of national Orientation	The teacher defines national Orientation as a process of communicating government policies staying abreast of public opinion and promoting patriotism, national unity and development of the Nigerian society. This work is carried out by the national orientation Agency. The purpose of national orientation is to alert the citizensgovernment to policies. To curb societal ills, to keep the citizens abreast with new directives from government; To inculcate good habits and attitudes in the citizens. CHALLENGES OF NATIONAL ORIENTATION. i. Illiteracy ii.Inadequate transportation i. Insufficient funds iv. Ethnicity Agencies of National Orientation. i. Ministry of information and national orientation ii. Boys scout iii. Man O' war iv. The Girls guide v. The boys brigade and different N.G.Os	Black marker Pamphlet produced Nat Orientation Age Teacher's notes of lesson	Explain national orientation Identify the benefits and purpose challenges of national Orientation.	The teacher gives the Students assignments in class test and take-home assignmen	Black marker Pamphlet produced by Nat Orientation Agency Teacher's notes of lesson

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY		
	COURSE CODE: GNS 102	**CREDIT HOURS:** 2
COURSE: Communication in English 1	**PRE-REQUISITE: 101**	**THEORETICAL: 2 HOURS/WEEK** **PRACTICAL : 0 HOURS/WEEK**

GOAL: This course is designed to enable students acquire the necessary communication skills, know the techniques of correspondence and comprehend written materials.

GENERAL OBJECTIVES: On completion of this course, the student should:

1.0 Understand the concept of communication.
2.0 Know how to make oral presentations.
3.0 Know the essential elements of correspondence.
4.0 Apply the rules of comprehension and interpretation

PROGRAMMES GENERAL STUDIES						
COURSE: Communication in English I						**CH/CU HOURS:** 2
GOAL: This course is designed to enable students acquire the necessary communication skills, know the techniques of correspondence and comprehend written materials.						
GENERAL OBJECTIVES: 1.0: Understand the concept of communication						
COURSE SPECIFICATION: THEORETICAL CONTENT						
	THEORETICAL CONTENT		**PRACTICAL CONTENT**			
WEEK	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**RESOURCE**	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**EVALUATION**
1-3	**Communication:** 1.1 Define communication. 1.2 Analyse the process of communication. 1.3 Enumerate the purposes of communication. 1.4 Explain the relationship between communication and language. 1.5 Explain the impact of interference on communication at various levels, e.g., phonological, syntactic etc. 1.6 Define code-mixing, code-switching and dissonance in communication.	Explain Communication. Describe the process of communication. Enumerates the purposes of communication. Explain the relationship between communication of language. Discuss the impact of interference on communication at various levels e.g. phonological syntactic etc. Explain code mixing, code switching and dissonance in communication.	Textbooks Projects DVD/CD Players White Board & Marker Internet	Define Communication Analyse the process of communication. Mention the purposes of communication. Identify the relationship between communication and language. Highlight the impact of interference on communication at various levels. Discuss with relevant examples code, mixing, code switching and dissonance in communication	Guide, supervise and correct students' activities.	Class work, Assignments and Test

GENERAL OBJECTIVES: 2.0: Know how to make oral presentations.						
4-6	**Oral Presentations:** 2.1 Label a diagram of the organs of speech. 2.2 Describe the functions of the organs in 2.1 above in speech production. 2.3 Identify the phonemes of English. 2.4 Pronounce correctly by making distinctions between the different sound contrasts in the consonantal and vowel systems of English. 2.5 Explain the principles of effective speaking, viz, correct use of stress, rhythm, and intonation patterns.	Draw and label a diagram of the organs of speech. Explain the functions of the organs of speech in speech production. Explain the phonemes of English. Pronounce and differentiate between the different consonant and vowels sounds. Enumerate the principles of effective speaking by exposing students to the correct use of stress, rhythm and intonation patterns.	Charts, pictures, DVD/CD player textbooks, whiteboard marker, projector, CD/DVD Internet	Draw and label the organs of speech . Explain the functions of the organs of speech. Pronounce correctly all the phonemes of English. Pronounce and make distinctions between the different consonant and vowels sounds of English. ➢ State the principles of effective speaking. ➢ Read fluently. ➢ Make short speeches.	Guide, supervise and correct students' activities.	Class work Assignments and Test.
GENERAL OBJECTIVES: 3.0: Know the essential elements of correspondence						
7- 10	**Correspondence:** 3.1 List the various types of correspondence e.g. letter (informal, semiformal & formal) memo, circular etc 3.2 Differentiate between informal, semi-formal, formal, semi-formal and	Explain the various types of correspondence, letters, memo, circular, notices. Explain informal, semi-	Textbooks Projects DVD/CD Players White Board & Marker Internet Samples of letters, memo, circulars etc.	Write letters, memos, circulars, notices etc.	Guide, supervise and correct students' activities.	Class work Assignments and Test

	formal letters. 3.3 Explain the various parts of a letter. 3.4 Explain the style suitable for formal and informal letters.	formal and formal letter. Explain the various parts of a letter: writer's address, date, recipient's address, salutation, subject, body, complimentary close, signature, full name of writer, designation (recently, phone number, email). Discuss the style suitable for formal and informal letters.		Write informal semi-formal and formal letters. Write letters paying attention to the various parts of the formal letter. Write formal and informal letters paying attention to style.		
GENERAL OBJECTIVES: 4.0: Apply the rules of comprehension and interpretation						
11-15	4.1 Identify main ideas in a given passage.	Explain main ideas from given passages.	Textbooks, CD/DVD Players, Projectors, White board marker Internet.	➢ Identify main ideas from given passages. ➢ Differentiate the main idea from the details in a given passage. ➢ Use main idea to anticipate specific details in a given passage. ➢ Identify relationship patterns of ideas in a given passage. Draw conclusions from given passages.	Guide, correct and assess students' work.	Class work Assignments and Test

	4.2 Draw conclusions from available information.	Explain how students can draw conclusions from available information.				

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY	**COURSE CODE: EEd 126**	**UNIT: 2**	**TOTAL CONTACT HOURS: 2**
COURSE TITLE: Introduction to Entrepreneurship			**THEORETICAL:2Hours/Week**
SEMESTER: 1	**Pre-requisite: -**		**PRACTICAL:0Hours/Week**
GOAL: This course is designed to develop the student's understanding and application of general principle of Entreprenuership Development			
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1.0 Understand the basic concept of entrepreneurship 2.0 Understand the historical perspective of entrepreneurship development 3.0 Know how to plan a business enterprise/project 4.0 Know how to operate simple stock keeping records 5.0 Know how to prepare and operate cash flow on spreadsheets 6.0 Understand employment issues 7.0 Understand the Nigerian Legal System 8.0 Comprehend the nature of contract and tort 9.0 Understand Agency and Partnership			

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY		COURSE CODE: EEd 126		UNIT: 5		TOTAL CONTACT HOURS: 2 HRS/WEEK
COURSE TITTLE **Introduction to Entrepreneurship**						THEORETICAL: 2 HOURS/WEEK 2HRS
SEMESTER 1		PRE-REQUISITE:-				PRACTICAL: 0HOURS/WEEK
GOAL: This course is designed to develop the student's understanding and application of general principle of Entreprenuership Development						
GENRAL OBJECTIVE 1.0: Understand the basic concept of entrepreneurship						
THEORETICAL CONTENTS				**PRACTICAL CONTENTS**		
WEEK/S	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1	1.1 Define entrepreneurship, entrepreneur, small business and self- employment. 1.2 State the entrepreneurship philosophy identify entrepreneurial characteristics. 1.3 Identify entrepreneurial characteristics. 1.4 Define development enterprise.	Explain to the students activities 1.1-1.4 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 2.0 Understand the historical perspective of entrepreneurship development						
2	2.1 Historical perspective. 2.2 Trace the origin of entrepreneurship. 2.3 Explain organizational structure. 2.4 Explain the role of an entrepreneur. 2.5 Explain the reasons for business failure.	Explain to the students activities 2.1-2.5 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 3.0: Know how to plan a business enterprise/project						
3-5	3.1 Define the concepts: planning, business enterprise and project. 3.2 Explain the importance of planning to a business enterprise. 3.3 Analyse the skills and Techniques of starting and managing small business	Explain to the students activities 3.1-3.5 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			

	successfully. 3.4 Prepare and present project proposal. 3.5 Manage a small business profitably					
GENERAL OBJECTIVE 4.0:. Know how to operate simple stock keeping records						
6	4.1 Ordering spare parts/materials 4.2 Receipt of parts/materials 4.3 Storage of parts/materials 4.4 Issue of parts/materials	Explain to the students activities 4.1-4.4 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 5.0: Know how to prepare and operate cash flow on spreadsheets						
7-8	1.1 Need for different records (capital, revenue, credit transaction, tax) 1.2 Formatting spreadsheet 1.3 Operating spreadsheet	Explain to the students activities 5.1-5.3 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 6.0: Understand employment issues						
9	6.1 Define the terms: education, training and development. 6.2 Retate education, training and development to employment. 6.3 Distinguish between skills and employment. 6.4 Explain the role of the private sector in employment generation. 6.4 Identify the forms and informal sectors 6.5 Explain the issues of: (i) Rural youth and employment (ii) Urgan youth and employment	Explain to the students activities 6.1-6.5 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 7.0: Understand the Nigerian Legal System						
10	7.1 Explain the nature of law. 7.2 Analyse the sources of Nigerian laws. 7.3 Evaluate the characteristics	Explain to the students activities 7.1-7.3 Prepare detailed lecture	Instructional materials Flip charts Projectors Video			

	of Nigerian Legal System.	notes and relevant diagrams with video clips	Internet			
GENERAL OBJECTIVE 8.0: Comprehend the nature of contract and tort						
11-12	8.1 Define contract. 8.2 Explain types of contracts 8.3 State the basic requirements for a valid contract. 8.4 Analyse contractual terms. 8.5 Examine vitiating terms. 8.6 Explain breach of contract and remedies. 8.7 Define Tort. 8.8 Explain types of Tort. 8.9 Discuss tortuous liabilities and remedies	Explain to the students activities 8.1-8.9 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			
GENERAL OBJECTIVE 9.0: Understand Agency and Partnership						
13	9.1 Define agency 9.2 Explain creation of Agency 9.3 Explain authority of the agent. 9.4 Analyse the rights and duties of principal agent and third parties. 9.5 Explain termination of agency and remedies 9.6 Define partnership. 9.7 Examine creation of partnership. 9.8 Explain relations of partners to one another and to persons dealing with them 9,9 Analyse dissolution of partnership and remedies.	Explain to the students activities 9.1-9.9 Prepare detailed lecture notes and relevant diagrams with video clips	Instructional materials Flip charts Projectors Video Internet			

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20

Total		100

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY	**COURSE CODE: MTH 113**	**UNIT:**	**TOTAL CONTACT HOURS: 2**
COURSE TITLE: ALGEBRA & ELEMENTARY TRIGONOMETRY			**THEORETICAL:2 Hours/week**
YEAR/SEMESTER: ND I /2	**Pre-requisite: -**		**PRACTICAL: 0 Hours/week**

GOAL: To enable the students acquire basic knowledge of algebra and trigonometry and apply same in solving problems in their areas of specialization

GENERAL OBJECTIVES: On completion of this course, the student will be able to:

1.0 Understand the laws of indices and their application in simplifying Algebraic expressions.
2.0 Understand the theory of logarithms and surds and their applications in manipulating expressions.
3.0 Understand principles underlying the construction of charts and graphs.
4.0 Know the different methods of solving quadratic equations.
5.0 Understand Permutation and Combination.
6.0 Understand the set theory.
7.0 Understand the properties of arithmetic and geometric progressions.
8.0 Understand the binomial and its application in the expansion of expressions
9.0 Understand the basic concepts and manipulation of vectors and complex number and their applications to the solution of engineering problems.
10.0 Understand the definition, manipulation and application of trigonometric function.
11.0 Understand the concept of equations and methods solving different types of equations and apply same to engineering problem.

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY						
COURSE: ALGEBRA AND ELEMENTARY TRIGONOMETRY				**CODE: MTH 113**		**CH/CU: 2**
GOAL: To enable the students acquire basic knowledge of algebra and trigonometry and apply same in solving problems in their areas of specialization.						
COURSE SPECIFICATION: THEORY/PRACTICAL CONTENT						
GENERAL OBJECTIVE 1.0: Understand The Laws of Indices And Their Applications In Simplifying Algebraic Expressions**.**						
	THEORETICAL CONTENTS			**PRACTICAL CONTENTS**		
WEEK/S	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1	1.1 Define indices. 1.2 State the laws of indices 1.3 Solve simple problems using the laws of indices.	Define indices. State the laws of indices. Solving simple problems using the laws of indices.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Define indices. Establish the laws of indices. Solve simple problems using the laws of indices.	Illustrate with example and Supervise the students' work. Explain laws of indices.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
GENERAL OBJECTIVE 2.0: Understand Theory of Logarithms, Surds And Their Applications In Manipulating Expression						
2-3	2.1 Define logarithms. 2.2 State the basic laws of logarithms. 2.3 Solve simple logarithms problems. 2.4 Define natural logarithms and common logarithms. 2.5 Define characteristics and mantissa 2.6 Read the logarithmic table for given numbers 2.7 Simplify numerical expressions using logarithms tables 2.8 Apply logarithm in solving non-linear	Definite of logarithms. Explain the basic laws of logarithms. Find simple logarithms problems Define natural logarithms and common logarithms. Explain characteristics and mantissa. Demonstrates the use of the logarithm table Explains the use of the	Recommended textbooks, whiteboard, Lecture notes logarithm table, multimedia projector, and computer.	Define logarithm. State the basic laws of logarithms. Solve simple logarithm problem. Define natural logarithm and common logarithm. Define characteristic and mantissa Read the logarithmic table for given numbers Simplify numerical expressions using	Observe, instruct and guide the students in the exercises. Supervise the students' work. Correct any error in the students' definitions and concepts. Illustrate with examples.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	equations. 2.9 Define surds 2.10 Reduce a surd into its simplest form 2.11 Solve simple problems on surds	logarithm table in simplifying numerical expressions. Defines surds. Demonstrates the reduction of surds into its simplest form. Solve simple problems on surds.		logarithms tables Apply logarithms in solving non-linear equations. Define surds Reduce a surd into its simplest form Solve simple problems on surds		
GENERAL OBJECTIVE 3.0: Understand Principles Underlying The Construction Of Charts And Graphs						
4	3.1 Construct graphs of functions such as $y = ax^n + b$ for n=1,2. $y = ax^k$ 3.2 Apply knowledge from 3.1 in the determination of laws from experimental data.	Describe how to construct graphs of functions such as, $y = ax^n + b$ for n = 1, 2. $y = ax^k$ Demonstrate with relevant examples how to determine laws from experimental data.	Recommended textbooks, whiteboard, graph book, Lecture notes, multimedia projector, and computer.	Construct graphs of functions such as Apply knowledge from 3.1 in the determination of laws from experimental data.	Supervise the students' work. Correct any error in the students' definitions and concepts	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
GENERAL OBJECTIVE 4.0: Know The Different Methods of Solving Quadratic Equations**.**						
5	4.1 Solve quadratic equations by factorization. 4.2 Solve quadratic equations by method of completing squares. 4.3 Solve quadratic equations by general formula. 4.4 Determine the roots of given quadratic equations. 4.5 Form quadratic equations from given	Explain how to solve quadratic equations using factorization method. Explain how to solve quadratic equations by method of completing and by general formula. Demonstrate formulation of quadratic equations from given roots.	Recommended textbooks, whiteboard, graph book, Lecture notes, multimedia projector, and computer.	Solve quadratic equations by factorization. Solve quadratic equations by method of completing squares. Solve quadratic equations by general formula. Form quadratic equations from given roots.	Supervise the students' work. Correct any error in the students' definitions and concepts	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	roots.					
GENERAL OBJECTIVE 5.0: Understand Permutations And Combinations.						
6	5.1 Define permutation. 5.2 State examples of permutations. 5.3 Establish the theorem $^{n}P_{r} = \frac{n!}{(n-r)!}$ 5.4 Define combination 5.5 State examples of combination. 5.6 Establish the theorem $^{n}C_{r} = \frac{n!}{(n-r)!r!}$ 5.7 Establish $^{n}C_{r} = {}^{n}C_{n-r}$	Define permutation. Illustrate permutation with examples. Establish the theorem $^{n}P_{r} = \frac{n!}{(n-r)!}$ Give the definition of combination Illustrate the idea of combination with examples. Establish the theorem $^{n}C_{r} = \frac{n!}{(n-r)!r!}$ Show that $^{n}C_{r} = {}^{n}C_{n-r}$	Recommended textbooks, whiteboard, graph sheets, Lecture notes, multimedia projector, and computer.	Define permutation. State examples of permutations. Establish the theorem $^{n}P_{r} = \frac{n!}{(n-r)!}$ Define combination. State examples of combination. Establish the theorem $^{n}C_{r} = \frac{n!}{(n-r)!r!}$ Establish $^{n}C_{r} = {}^{n}C_{n-r}$	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
GENERAL OBJECTIVE 6.0: Understand Set Theory						
7	6.1 Define sets, subsets, and null sets 6.2 Define union, intersection and complement of sets. 6.3 Draw Venn diagrams to	Define of sets, subsets, null sets, union, inter-section and complement of sets. Demonstrate representation of sets	Recommended textbooks, whiteboard, graph book, Lecture notes, multimedia projector, and computer.	Define sets, subsets, and null sets Define union, intersection and completion of sets. Draw Venn diagrams to	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	demonstrate the concepts in 6.2 above. 6.4 Calculate the size or number of elements in a given set. 6.5 Solve word problems on set.	using Venn diagrams.		demonstrate the concepts in 6.2 above. Calculate the size or number of elements in a given set. Solve word problems on set.	guide the students in the exercises. Supervise the students' work.	
GENERAL OBJECTIVE 7.0: Understand The Properties of Arithmetic And Geometric Progression.						
8-9	7.1 Define arithmetic progressions (A.P) 7.2 Obtain the formula for nth term and the first n terms of an A.P 7.3 Solve problems on A.P 7.4 Define a geometric progression (G.P) 7.5 Obtain the formula for the nth term and the first n terms of a geometric progression. 7.6 State examples of 7.5 above. 7.7 Define Arithmetic Mean (A.M) and Geometric Mean (G.M) 7.8 Define convergence of series. 7.9 Define divergence of series.	Define arithmetic progressions (A.P) Obtain the formula for nth term and the first n terms of an A.P Describe how to solve problems on A.P Define a geometric progression (G.P) Explain how to obtain the formula for the nth term and the first n terms of a geometric progression. Define Arithmetic Mean (A.M) and Geometric Mean (G.M) Define convergence of series. Define divergence of series	Recommended textbooks, whiteboard, graph sheets, Lecture notes, multimedia projector, and computer.	Define arithmetic progressions (A.P) Obtain the formula for nth term and the first n terms of an A.P Solve problems on A.P Define a geometric progression (G.P) Obtain the formula for the nth term and the first n terms of a geometric progression. • Define Arithmetic Mean (A.M) and Geometric Mean (G.M.) • Define convergence of series. • Define divergence of series.	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.
GENERAL OBJECTIVE 8.0: Understand The Binomial Theorem And Its Application In The Expansion Of Expressions.						

10-11	8.1 Explain the method of mathematical induction. 8.2 State and prove the binomial theorem for a positive integral index. 8.3 Expand expressions of the forms $(x+y)^2$, $(x\pm1)^5$, applying binominal theorem. 8.4 Find the coefficient of a particular term in the expansion of simple binomial expressions. 8.5 Find the middle terms in the expansion of binomial expression. 8.6 State the binomial theorem for a rational index. 8.7 Expand expressions of the form: $(1+x)^{-1}$, $(1\pm x)^{1/2}$, $(1\pm x)^{-1/3}$ applying binomial theorem 8.8 Expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$, $(1+x)^{1/2}$, $(1\pm x)^{1/3}$ to a stated degree of accuracy	Explain the method of mathematical induction. State and prove the binomial theorem for a positive integral index. Show the expansion of expressions of the forms $(x+y)^2$, $(x\pm1)^5$, etc and applying binominal theorem. Find the coefficient of a particular term in the expansion of simple binomial expressions. Show how to find the middle terms in the expansion of binomial expression. State the binomial theorem for a rational index. Demonstrate the expansion of expressions of the form: $(1+x)^{-1}$, $(1\pm x)^{1/2}$, $(1\pm x)^{-1/3}$ applying binomial theorem. Guide the student to expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$,	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Explain the method of mathematical induction. State and prove the binomial theorem for a positive integral index. Expand expressions of the forms $(x+y)^2$, $(x\pm1)^5$, etcand applying binominal theorem. Find the coefficient of a particular term in the expansion of simple binomial expressions. Find the middle terms in the expansion of binomial expression. State the binomial theorem for a rational index. Expand expressions of the form: $(1+x)^{-1}$, $(1\pm x)^{1/2}$, $(1\pm x)^{-1/3}$ applying binomial theorem Expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$, $(1+x)^{1/2}$, $(1\pm x)^{1/3}$ to a stated degree of accuracy	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

		$(1+x)^{1/2}, (1\pm x)^{1/3}$ to a stated degree of accuracy				
GENERAL OBJECTIVE 9.0: Understand The Basic Concepts And Manipulation Of Vectors And Their Applications To The Solutions of Engineering Problems**.**						
12-13	9.1 State the definitions and representations of vectors. 9.2 Identify vector quantities. 9.3 Define a position vector. 9.4 Define unit vector 9.5 Explain scalar multiple of a vector 9.6 List the characteristics of parallel vectors 9.7 Compute the modulus of any given vector up to 2 and 3 dimensions. 9.8 State the parallelogram law for addition and subtraction of vectors 9.9 Apply the parallelogram law in solving problems. 9.10 Explain the concept of components of a vector and the meaning of orthogonal components. 9.11 Resolve a vector into its orthogonal components. 9.12 List characteristics of coplanar localized vectors. 9.13 Define the resultant or composition of	State the definitions and representations of vectors. Define a position vector. Define unit vector Explain scalar multiple of a vector. List the characteristics of parallel vectors Demonstrate computation of the modulus of any given vector up to 2 and 3 dimensions. State the parallelogram law for addition and subtraction of vectors Apply the parallelogram law in solving problems. Explain the concept of components of a vector and the meaning of orthogonal components.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	State the definitions and representations of vectors. Identify quantities that may be classified as vector. Define a position vector and a unit vector Explain scalar multiple of a vector List the characteristics of parallel vectors Compute the modulus of any given vector up to 2 and 3 dimensions. State the parallelogram law for addition and subtraction of vectors, and apply it to solve problems. Explain the concept of components of a vector and the meaning of orthogonal Components. Resolve a vector into its orthogonal components. List characteristics of coplanar localized vectors.	Correct any error in the students' definitions and work. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	coplanar vectors. 9.14 Compute the resultant of coplanar forces acting at a point using algebraic and graphical methods. 9.15 Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. 9.16 Apply vector techniques in solving problems involving relative velocity. 9.17 State the scalar product of two vectors. 9.18 Compute the scalar product of given vectors. 9.19 Define the cross product of the vector product or two vectors. 9.20 Calculate the direction ratios of given vectors. 9.21 Calculate the angle between two vectors using the scalar product.	Resolve a vector into its orthogonal components. List characteristics of coplanar localized vectors. Define the resultant or composition of coplanar vectors. Compute the resultant of coplanar forces acting at a point using algebraic and graphical methods. Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. Apply vector techniques in solving problems involving relative velocity. State the scalar product of two vectors. Compute the scalar product of given vectors. Define the cross product of the vector product or two vectors. Calculate the direction ratios of given vectors. Calculate the angle between two vectors		Define the resultant or composition of coplanar vectors and compute the resultant of coplanar forces acting at a point using algebraic and graphical methods. Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. Apply vector techniques in solving problems involving relative velocity. State and compute the scalar product of two vectors. Define the cross product of the vector product or two vectors. Calculate the direction ratios of given vectors and the angle between two vectors using the scalar product		

		using the scalar product.				
GENERAL OBJECTIVE 10.0 Know The Concept To Solve Linear Simultaneous Equation With Two Unknown Variables						
14	10.1 Explain the concept of equation. 10.2 List different types of equations; linear, quadratic, cubic, etc. 10.3 State examples of linear simultaneous equations in two unknowns and simultaneous equations with at least one quadratic equation. 10.4 Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation. 10.5 Define a determinant of nth order. 10.6 Apply determinants of order 2 and 3 in solving simultaneous linear equation.	Explain the concept of equation. List different types of equations; linear, quadratic, cubic, etc. Give examples of linear simultaneous equations in two unknowns and simultaneous equations with at least one quadratic equation. Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation. Define a determinant of nth order. Apply determinants of order 2 and 3 in solving simultaneous linear equation.	Recommended textbooks, whiteboard, graph sheets, Lecture notes, multimedia projector, and computer.	Explain the concept of equation. List different types of equations; linear, quadratic, cubic, etc. Give examples of linear simultaneous equations in two unknowns and simultaneous equations with at least one quadratic equation. Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation. Define a determinant of nth order. Apply determinants of order 2 and 3 in solving simultaneous linear equation.	Correct any error in the students' definitions and work. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

GENERAL OBJECTIVE 11.0 Understand The Concept Of Trigonometric Functions And Apply Them In Solving Problems.						
15	11.1Define the basic trigonometric ratios, sine, cosine and tangent of an angle. 11.2Derive the other trigonometric ratios; cosecant, secant and cotangent using the basic trigonometric ratios in 11.1 above. 11.3 Derive identities involving the trigonometric ratios; $Cos^2\theta+Sin^2\theta = 1$, $Sec^2\theta = 1 + tan^2\theta$, etc. 11.4 Derive compound angle formulae for sin (A+B), Cos (A+B) and Tan (A+B).	Define the basic trigonometric ratios. Derive the reciprocal of basic trigonometric ratios. Derive special identities involving the trigonometric ratios. Derive compound angle formulae for sine, cosine and tangent.	Recommended textbooks, whiteboard, graph sheets, Lecture notes, multimedia projector, and computer.	Define the basic trigonometric ratios. Derive the reciprocal of basic trigonometric ratios. Derive special identities involving the trigonometric ratios. Define the basic trigonometric ratios. Derive the reciprocal of basic trigonometric ratios. Derive special identities involving the trigonometric ratios. Derive compound angle formulae for sine, cosine and tangent.	Correct any error in the students' definitions and work. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: SCIENCE AND PRPPERTIES OF MATERIALS	**Course Code:** CEC 104	**UNIT: 5**	**CONTACT HOURS: 5 HRS/WEEK**
			THEORETICAL: 2HOURS/WEEK
YEAR/SEMESTER:ND 1/ 2	**PRE-REQUISITE: NONE**		**PRACTICAL: 3HOURS/WEEK**

Goal :The course is designed to enable students to acquire basic knowledge of Propeerties of Materials

GENERAL OBJECTIVES

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

1. Understand the internal structure of the atom**.**
2. Understand the microstructure of solids
3. Understand the macroscopic properties of materials
4. Know various types and properties of aggregates used in Civil Engineering
5. Know types and properties of other materials used in Civil Engineering Construction**.**
6. Know the types and properties of cement.
7. Understand the properties and uses of concrete.
8. Know Properties and Uses of Ferrocement

COURSE TITLE: SCIENCE AND PRPPERTIES OF MATERIALS		**COURSE CODE:** CEC 104		**UNIT:5**		**CONTACT HOURS: 5 HRS/WEEKS**
						THEORETICAL: 2HOURS/ WEEK
Goal : The course is designed to enable students to acquire basic knowledge of Propeerties of Materials						
YEAR/SEMESTER: ND I/ 2nd		**PRE-REQUISITE :-**				**PRACTICAL: 2 HOURS/ WEEK**
	1. **General Objective 1.0:** Understand the internal structure of the atom					
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
WEEK /S	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OUTCOMES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define clearly the characteristics of electron, proton, and neutron. 1.2 Predict element positions in the periodic table. 1.3 Explain exceptions to rule of thumb. 1.4 Describe the duality concept clearly. 1.5 Describe clearly the Wave and Corpuscular models. 1.6 Explain De-Broglie's expressions. 1.7 Explain schrodinger's equation. 1.8 Derive Bohr's conc'usion. 1.9 Describe how Bohr's conclusion explains atomic equilibrum, excitation, ionization state. 1.10Illustrate ionic, co-vallent and metallic bonds.	Explain to the students activities 1.1-1.10. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia	-	-	-

	General Objective 2.0: Understand the microstructure of solids					
3-4	2.1 Describe clearly the crystalline structure of metals, ceramics, etc. 2.2 Describe clearly the crystalline nature of polymer fibres. 2.3 Describe separate phases, alloys filled materials and composite materials. 2.4 Describe, in detail, the various methods of studying microstructures. 2.5 Illustrate these with diagrams. 2.6 Describe the behaviour of charge carriers. 2.7 Differentiate between majority and minority charge carriers. 2.8 Define charge density and temperature. 2.9 Define mobility, diffusion and conductivity.	Explain to the students activities 2.1-2.9. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			

	General Objective 3.0: Understand the macroscopic properties of materials					
5-6	3.1 Explain the relationship between macroscopic properties and structural properties. 3.2 Distinguish between elastic and plastic deformation. 3.3 Define stress and strain . 3.4 State the relationship between stress and strain. 3.5 Define modulus of elasticity. 3.6 Determine 3.5 by experiment and from experimental data. 3.7 Define yield, plastic flow, creep. 3.8 Define conductors and semiconductors. 3.9 Describe dielectric, piezeoelectric, and magnetic properties of solids.	Explain to the students activities 3.1-3.9. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			
	General Objective 4.0 Know various types and properties of aggregates used in Civil Engineering					
4-5	4.1 State Civil Engineering aggregates. 4.2 Describe various common quarrying methods. 4.3 Explain the properties of aggregate e.g porosity, absorption, void ratio, etc. 4.4 Describe tests for cleanliness, silt test. 4.5 Describe methods of moisture content determination and uses. 4.6 Describe grading methods. 4.7 Perform grading test. 4.8 Describe crushing strength tests.	Explain to the students activities 4.1-4.9. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			

	4.9 Perform the crushing strength tests.					
	General Objective: 5.0: Know types and properties of other materials used in Civil Engineering Construction					
6-7	5.1 Describe the use and application of stones in construction works 5.2 Describe the use and application of earth, soil and laterite construction works. 5.3 Describe the production and usage of fired clay in construction works. 5.4 Describe the uses of binders in construction works 5.5 Describe use of plastics in construction works. 5.6 Describe types and properties of glass. 5.7 Describe use and application of tar, bitumen and ashphalt. 5.8 State types and properties of asbestos. 5.9 Define corrosion. 5.10 State effects of corrosion as well as methods of prevention.	Explain to the students activities 5.1-5.10. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			

	General Objective: 6.0: Know the types and properties of cement.					
8	6.1 Distinguish between, the different types of cement. 6.2 Describe the methods of cement manufacture. 6.3 Describe the acceptability tests for cement, e.g fineness, setting time, soundness, etc. 6.4 Perform the acceptability tests for cement.	Explain to the students activities 6.1-6.4. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			

	General Objective: 7.0: Understand the properties and uses of concrete.					
9-11	7.1 Describe, with illustrations, proper and improper storage of materials. 7.2 Describe concrete batching, mixing and transporting methods. 7.3 Describe standard tests for concrete e.g slumps tests, compaction factor, compressive strength test (cube, cylinder). 7.4 Perform standard tests in 7.3 7.5 Describe types of concrete pumps, placers, vibrators, etc. 7.6 Describe proper protection and curing of concrete. 7.7 Describe, with illustration, the bending and fixing of reinforcement. 7.8 Illustrate, with sketches, different types of joints in concrete. 7.9 Define proper concrete finishes. 7.10 State the effect of corrosion on metals with regard to structural stability. 7.11 State the causes of and methods of preventing corrosion.	Explain to the students activities 7.1-7.11. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			

	General Objective: 8.0: Know Properties and Uses of Ferrocement					
12-15	8.1 Explain the meaning of ferrocement. 8.2 Distinguish between sandcrete, reinforced concrete and ferrocement. 8.3 Enumerate the uses of ferrocement in: a. Building construction; b. Underground construction works; c. Airport facilities; d. Road works; e. Water projects and f. Agricultural facilities. 8.4 Describe the properties of ferrocement such as: (a) tensile (b) flexural strength (c) compressive strength (d) impact and fatigue strength (e) water (or liquod) retaining capacity. Etc. 8.5 Enumerate the guidelines for the use of ferrocement e.g (a) Materials (b) Testing (c) Design (d) Construction. 8.6 Discuss the criteria of choice of micro-reinforcement in concrete composites. 8.7 Explain the use of ferrocement as a means of producing skinned elements in buildings e.g ribbed plates, floor slabs, walls, joints below floor slabs and walls etc. 8.8 Explain the properties of bamboo that make it useful in construction industry. 8.9 Describe the construction of the following with bamboo: a. split-bamboo piles (foundation) b. bamboo floor	Explain to the students activities 8.1-8.19. Prepare detailed lecture notes and relevant diagrams with video clips.	Lecture notes, video clips and Multimedia			

	c. bamboo reinforced earth walls d. bamboo roofs structures e.g. i. barrel vault ii. small geodesic dome iii. grid shell on a square base iv. irregularly shaped grid shells v. bamboo trusses vi. bamboo shingles with splint or string fixing vii. bamboo shingles as Spanish tiles					

PROGRAMME: ND CEMENT ENGINEERING TECHNOLOGY			
Course: Science and Properties of Materials	**Course Code: CEC 104**		**Contact Hours: 2 – 0 - 3**
Course Specification: Practical Content			
WEEK	**General Objective: Conduct Practicals to explain the theoretical Content**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**
2	Carry out the following tests on a given cement sample: a. Consistency b. Initial and final setting time c. Soundness	▪ Technologist to prepare cement and concrete samples in the presence of the students and monitor students during the practical. ▪ He is to grade students reports and submit to lecturer. ▪ The course lecturer is to supervise the above activities and collate the results of the graded practical.	▪ Vicat apparatus ▪ Le Chatelier test apparatus, ▪ 150mm cube moulds, ▪ 150mm cylindrical moulds ▪ Engine oil ▪ Curing tank fall of water. ▪ DEMIC gauge
3 – 5	Perform the following tests on samples of concrete. a. Cast concrete cubes 12 in number and one cylindrical in shape. b. Cure in water c. Test 3 samples of cube after 7 days d. Test 3 samples of cube after 14 days e. Test 3 samples of cube after 28 days Compare results obtained with those specified in BS 12. Text the cylindrical concrete after 28 days and obtain the modulus of elasticity of concrete.		
6	Determine modulus of elasticity.		
7	Perform grading tests and crushing strength tests on concrete.		
8 – 9	Carry out field tests on soils and laterite.		
10 – 11	Carry out laboratory tests on soil and laterite.		

12	Carry out structural properties of ferrocementi.e tensile, cracking, in pact strength fatigue strength, compressive strength.		
13 – 15	Design and construct a structure with either ferrocement or bamboo.		

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

Programme: NATIONAL DIPLOMA IN RAILWAY ENGINEERINGTECHNOLOGY	**Course Code: SUG 102**	**Credit Hours: 4**
Course: Basic Principles in Surveying II	**Pre-Requisite: - SUG 101**	**Theoretical: 1 Hours/Week**
Year : ND I Semester: 2		**Practical: 3 Hours/Week**

Goal: The course is designed to enable students acquire knowledge of Surveying equipment and methods for electro-magnetic distance measurements

GENERAL OBJECTIVES

On completion of this course, the Student should be:

1.0 Understand the use of equipment and methods for electro-magnetic distance measurement.
2.0 Understand the procedure and methods of third order theodolite and total station traversing
3.0 Understand the principles, field methods and calculation procedures for minor triangulation.
4.0 Understand the methods of heighting and tertiary levelling.
5.0 Understand problems involved in producing contoured plans.
6.0 Understand setting out procedure for a medium sized building including access roads.

PROGRAMME: NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Basic Principles in Surveying II			**COURSE CODE: SUG 102**		**CONTACT HOURS: 4HRS**	
Course Specification: Theoretical Contents				**Practical Content**		
Goal: The course is designed to enable students acquire knowledge of Surveying equipment and methods for electro-magnetic distance measurements						
	General Objective: 1.0 Understand the use of equipment and methods for electro-magnetic distance measurement.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
1-2	1.1 Observe small vertical angles precisely by repetition. 1.2 Determine horizontal distance using vertical stage and tacheometer. 1.3 Explain special characteristics and use of self-reducing tacheometer. 1.4 Measure distance using a theodolite as tacheometer. 1.5 Determine spot-height and survey detail by tacheometry. 1.6 Measure distance using EDM and total station. 1.7 Work out accuracies attainable in various methods of Electromagnetic distance measurement (EDM).	Explain activities 1.1 to 1. 7 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station EDM	1.1 Carryout a measurement of about 2km using EDM. 1.2 Carryout a boundary survey of a small area using third order theodolite and total stations. 1.3 Carryout a computation of traverses in 2 above. 1.4 Carryout a minor triangulation scheme. 1.5 Carryout a computation of the triangulation net. 1.6 Carryout levelling a distance of a distance of about 2km using ordinary and digital spirit levels. 1.7 Carryout computations of the levelling. 1.8 Carryout topographical survey of a given area.	Guide students to conduct practicals	Explain special characteristics and use of self-reducing tacheometer.

	General Objective: 2.0 Understand the procedure and methods of third order theodolite and total station traversing					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
3-5	2.1 Identify the various items of equipment used in theodolite and total station traversing. 2.2 List specifications for equipment of angles and distances, determination of bearings and tolerable linear and angular misclosures for tertiary traverses. 2.3 Explain the need for connection to and procedure for verification of existing controls. 2.4 Describe field methods of traversing using surface taping. 2.5 Explain the various precautions in field measurements. 2.6 Describe the field checks applicable. 2.7 Use the force centring equipment explaining special advantage thereof. 2.8 Explain the role of theodilite and total station traversing in provision of control for surveys. 2.9 Carryout total station traverse using surface taping. Verifying the control to which the survey is connected,	Explain activities 2.1 to 2. 9 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station EDM	2.1 Identify the various items of equipment used in theodolite and total station traversing. 2.2 Carryout total station traverse using surface taping. Verifying the control to which the survey is connected, surveying adjacent detail (by radiation and intersection), computing g the traverse, adjusting distances, bearings and coordinates and producing a plan in ink.	Guide students to conduct practicals	Explain the concept of traversing

	surveying adjacent detail (by radiation and intersection), computing g the traverse, adjusting distances, bearings and coordinates and producing a plan in ink.					
	General Objective: 3.0 Understand the principles, field methods and calculation procedures for minor triangulation.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
6-7	3.1 Explain the basic principles of triangulation. 3.2 Enumerate other parameters of triangulation such as selection, beaconing, numbering of triangulation stations, baseline, azimuth determination, extension of connected triangles, angular repletion, reciprocal observations, angular misclosures, field measurement checks etc. 3.3 Explain methods of computing coordinates and heights from filed records. 3.4 Carry out minor triangulation in area of 100sq.m. 3.5 Carryout GPS observation on the triangulation stations in 3.4 above. 3.6 Identify the relative merits and demerits of triangulation and GPS methods.	Explain activities 3.1 to 3. 6 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station GPS	3.1 Carry out minor triangulation in area of 100sq.m. 3.2 Carryout GPS observation on the triangulation stations 3.3 Identify the relative merits and demerits of triangulation and GPS methods.	Guide students to conduct practicals	Explain minor triangulation

	General Objective: 4.0 Understand the methods of heighting and tertiary levelling.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
8-10	4.1 List the basic principles of ordinary spirit levelling and digital spirit levelling. 4.2 List specifications of tertiary levelling. 4.3 Explain the (optimum) observing procedure. 4.4 Describe the use of and criteria for selection of levelling datums. 4.5 Adjust collimination error in level. 4.6 Describe the construction and use of semi-permanent and permanent tertiary bench-marks. 4.7 Books field observations. 4.8 Reduce level. 4.9 Explain arithmetical checks in level reduction. 4.10 Carry out tertiary levelling, reduction and adjustment to produce elevations of all permanent stations along a circuit of about 2km, using ordinary and digital levels. 4.11 Enumerate the uses of tertiary levelling.	Explain activities 4.1 to 4. 11 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station GPS	4.1 Adjust collimination error in level. 4.2 Carry out tertiary levelling, reduction and adjustment to produce elevations of all permanent stations along a circuit of about 2km, using ordinary and digital levels.	Guide students to conduct practicals	Explain the tertiary levelling

	General Objective: 5.0 Understand problems involved in producing contoured plans.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
11-12	5.1 Name the different reference directions describing method of determining these and explain their mutual relationships. 5.2 Explain basic need for heights in Topographical, Engineering and Township Surveys. 5.3 Illustrate optimum distribution of spot heights for contoured plans. 5.4 Describe the use of grids of levels. 5.5 Carry out contouring at 0.5m. vertical interval from a mesh of spot heights.	Explain activities 5.1 to 5. 5 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station GPS	5.1 Carry out contouring at 0.5m. Vertical interval from a mesh of spot heights.	Guide students to conduct practical	Explain the concept of contoured plans

	General Objective: 6.0 Understand setting out procedure for a medium sized building including access roads.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Evaluation**
13-15	6.1 Identify the equipment required to set-out a building with accompanying access roads. 6.2 Explain how to set-out a building and the accompanying constraints. 6.3 Construct profiles and datum for a building. 6.4 Explain how profiles are used to control excavation and foundation levels. 6.5 Identify the instruments used for taking internal and external dimensions. 6.6 Determine the areas of a building and its site. 6.7 Explain how running internal and external measurements are taken horizontally and vertically. 6.8 State the procedure for checking vertically of building using Theodolite, Optical Plumb and Plumb-Bulb. 6.9 Describe the invert of a drain, a sight rail and a traveler. 6.10 Calculate suitable length of a traveler and reduced levels of sight rails from given drawings.	Explain activities 6.1 to 6. 15 to students	White board Projector Linen tapes Steel tapes Ranging rods Prismatic compass Theodolite Total station GPS	6.1 Identify the equipment required to set-out a building with accompanying access roads. 6.2 Construct profiles and datum for a building. 6.3 Identify the instruments used for taking internal and external dimensions. 6.4 Determine the areas of a building and its sites.	Guide students to conduct practical	State setting out procedure for a medium sized building including access roads

	6.11 Establish sight rails for horizontal and depth control of a straight drain between manholes. 6.12 Explain the survey terms used in road construction. 6.13 Describe methods of route surveying. 6.14 Describe the types of control used for Embankments, cuttings and levels. 6.15 Calculate volumes of cut and fill on a given straight road with transverse sloping ground.					

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: BASIC RAILWAY SIGNALLING AND COMMUNICATIONS	**COURSE CODE:** RWE 121	**UNIT: 3**	**CONTACT HOURS: 3HOURS/WEEK**
			THEORETICAL:1 HOUR/WEEK
SEMESTER: ONE	**PRE-REQUISITE : NONE**		**PRACTICAL: 2HOURS/WEEK**

Goal: The course is designed to enable students acquire training for railway signaling and communications.

General Objectives:

On Completion of this course, the students should be able to:

1.0 Understand the elementary idea of current flow.

2.0 Know the application of ohm's law.

3.0 Understand the application of Kirchhoff's law.

4.0 Understand the concept of power and energy.

5.0 Understand the effect of electric current.

6.0 Understand the principles of Electromagnetic Induction.

7.0 Understand the basic phenomenon of electrostatics.

8.0 Know the basicsof Alternating Current (A.C)/ Direct Current (D.C) theory.

9.0 Understand Signal and Communications fundamentals

10.0 Understand Route Relay interlocking (RRI) and Central Control Panel in Signal Control Systems

11.0 Understand train Control Communications

12.0 Understand the concept of Operation Signal

13.0 Understand Railway Telephone network

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**		
COURSE: BASIC SIGNALLING AND COMMUNICATION S	**COURSE CODE**: RWE 121	**CONTACT HOURS**: 3 HOURS
GOAL: This course is designed to enable students acquire training for railway signaling and communications.		
GENERAL OBJECTIVE 1.0: Understand the elementary idea of current flow.		

COURSE SPECIFICATION: **THEORETICAL CONTENT**				COURSE SPECIFICATION: **PRACTICAL CONTENT**		
Week	***Specific Learning Outcomes***	***Teacher's Activities***	***Learning Resources***	***Specific Learning Outcomes***	***Teacher's Activities***	***Evaluation***
1	**1.1** State the Composition of an atom and their corresponding charges. **1.2** Define electric Current. **1.3** Explain the concept of resistance, potential difference and electromotive force. **1.4** State the unit of current, resistance, potential difference and electromotive force 1.5 Define the unit of current resistance, potential difference and electromotive force	Explain Activities 1.1 – 1.5	White board, Projector and relevant textbooks Electrical Symbols Multimetres and AC devices	Determine the unit of current, resistance, potential difference and electromotive force.	Carryout practical experiment to determine the unit of current, resistance, potential difference and electromotive force.	State the difference between resistance, potential difference and electromagnetic force

	GENERAL OBJECTIVE 2.0: Know The Application of Ohm's Law**.**					
2	2.1 State ohm's law. 2.2 Verify ohm's law by experiment 2.3 Solve problems applying ohm's law to basic electrical circuits. 2.4 Determine the equivalent resistance in series and parallel. 2.5 Solve problems in 2.3 and 2.4	Explain activities 2.1-2.5	White board Projector Multimetres AC devices and resistors	Verify ohm's law by experiment Determine the equivalent resistance in series and parallel.	Carryout experiment to determine the equivalent resistance in series and parallel	State Ohm's law. Differentiate between series and parallel resistors connections.
	GENERAL OBJECTIVE: 3.0 Understand The Application Of Kirchhoff's Law**.**					
3	3.1 State Kirchhoff's 1st and 2nd law. 3.2 Solve simple problems involving Kirchhoff's 1st and 2nd law.	Explain activities 3.1and 3.2.	White board, Projector	-	-	-
	GENERAL OBJECTIVE: 4.0 Understand The Concept Of Power And Energy**.**					
4	4.1 Define power and energy. 4.2 State the relationship between power, time, current, voltage and resistance. 4.3 Write formula for energy using the relationship	Explain activities 4.1- 4.4	White board, Projector.	-	-	-

	between power, time, current, voltage and resistance. 4.4 Solve problems on relationship between power, time, current, voltage and resistance.					
	GENERAL OBJECTIVE: 5.0 Understand The Effect of Electric Current**.**					
5-6	5.1 State the three effects of electric current. 5.2 Explain how heat energy is produced by passage of current through a resistor (conductor). 5.3 State practical application of the heating effect of electric current. (cooker, electric iron, electric furnaces, thermocouple) 5.4 Explain how chemical reaction occurs when current passes through an electrolyte. 5.5 Explain Faraday's law of electrochemical equivalent. 5.6 Solve problems involving faraday's law of	Explain activities 5.1 – 5.16.	White board. Projector. Multimetres. Resistors	Determine the heating effect of electric current experimentally. Determine Faraday's law experimentally. Plot the magnetic field produced by a straight conductor, two parallel conductors and solenoid. Determine the direction of the force on conductor carrying current which is situated in the magnetic field. Determine the direction of the force on conductor carrying current situated in magnetic field using the Fleming's left-hand rule.	Guide the Student to verify the heating effect of electric current. Guide the Students to verify Faraday's law. Perform experiment to determine the direction of the force on conductor carrying current which is situated in the magnetic field.	State the effect of electric current on a conductor

	electrochemical equivalent 5.7 Explain the chemical reaction in electroplating and electrolysis in car Battery. 5.8 Explain the magnetic effect of electric current. 5.9 Explain the right hand grip-rule. 5.10 State the cork screw rule. 5.11 Explain how force is exerted on a conductor carrying current which is situated in a magnetic field. 5.12 State the relationship between the force, the current and the flux. 5.13 Solve problems on the relationship between the force, the current and the flux. 5.14 Explain how magnetic effect is made use of in the moving coil instrument, electric bell, motors, etc. 5.15 Explain how the					

	magnetic effect is made use of in the moving coil instrument, electric bell, motors, etc. 5.16 Explain the detailed construction of how the magnetic effect is made use of in the moving coil instrument, electric bell, motors, etc.					
	GENERAL OBJECTIVE: 6.0 Understand the Principles of Electromagnetic Induction					
7	6.1 Explain the principles of induction. 6.2 State Fleming's law. 6.3 Explain the principle of coil in the Car ignition system. 6.4 Explain the construction of the generator.	Explain activities 6.1-6.5	White board. Projector. Ignition coil. Generator. Galvanometre. Multimetre Rheostat	Determine the magnetic flux line. Determine the voltage input and output in a coil ignition system. Demonstrate how Direct Current (DC) produced by a generator is converted to an Alternating Current (AC).	Perform experiment to determine the magnetic flux line. Guides the Students to demonstrate the process of current conversion from DC to AC.	Explain the process of current conversion from DC to AC.
	GENERAL OBJECTIVE: 7.0 Understand the Basic Phenomenon of Electrostatics					
8	7.1 Explain theprinciples of electric charges. 7.2 Define the colour codes. 7.3 Define capacitance.	Explain activies 7.1-7.9.	White board, Projector, Capacitor,	Construct a simple parallel plate capacitor.	Guide the Students to construct a simple parallel plate capacitor.	State the importance of Capacitor in a simple parallel plate.

	7.4 Explain the use of capacitor as an electrical charge storing device. 7.5 Describe the construction of a simple parallel plate capacitor. 7.6 State formula relating to capacitance to area of plates, thickness of the dielectric. 7.7 State the relationship between charges applied, voltage and capacitance. 7.8 Derive expression for capacitors in series and parallel. 7.9 Solve problems on 7.7 and 7.8.					State the factors that affect the capacitance of a parallel plate

	GENERAL OBJECTIVE: 8.0 Know The Basic A.C Theory					
9	8.1 Explain the A.C wave forms (sinusoidal, triangular, square, saw tooth, etc.) 8.2 Define the common AC frequency period, cycle, and instantaneous value from factor value. 8.3 Draw relationship between root mean square values, average value, and peak value, crest value and form factor. 8.4 Solve problems on 8.3. 8.5 Illustrate graphically the relationship between current and voltage in AC circuit containing resistance, capacitor and inductor both separately and combined. 8.6 Derive expression for series and parallel and complex impedance. 8.7 Define apparent power (A), reactive power (Q), and active power (P). 8.8 State that power factor is the ratio of active to	Explain activities 8.1 to 8.9.	White board, Projector, Capacitor, Resistor, Inductor Multimetre	Illustrate graphically the relationship between current and voltage in AC circuit containing resistance, capacitor and inductor both separately and combined.	Guides student to illustrate relationship between current and voltage in AC circuit containing resistance, capacitor and inductor both separately and combined.	State three type of powers in an AC circuit. State the conditions necessary for occurrence of resonance frequency in an AC circuit.

	apparent power. 8.9 Solve problems relating to 8.6,8.7,8.8					
	GENERAL OBJECTIVE 9.0 Understand Signal and Communications Fundamentals					
10	9.1Define signalling and communications in railway Engineering Technology 9.2 Classify signal 9.3 Describe: (i) Stop signal or Semaphore signal (ii) Disc signal (iii) Collared light signal • Outer signal • Home signal • Starts signal • Advance signal • Routing signal • Calling signal 9.4 Define route indicators in signalling 9.5 List types of route indicators 9.6 List various types of layout signals 9.7 Describe types of train movements controls. 9.8 Define interlocking	Explain activities 9.1 to 9.8.	Marker Boards, Projector, Semaphore devise Disc devise Colored light devise Lever Chart	Identify devices used in signaling Identify control movements used in train	Carryout classification of signal into groups Demonstrate semaphore signal and others Demonstrate indicators used in signaling	State the three types of signaling devices used in train movement controls

GENERAL OBJECTIVE 10.0 Understand Route Relay Interlocking (RRI) and Control Panel in Signal Control System						
11	10.1 Define relay interlocking 10.2 Explain principles of relay interlocking 10.3 Explain why relay interlocking is necessary 10.4 Describe method of relay Interlocking 10.5 Describe devices used in relay interlocking 10.6 Explain Route Relay Interlocking 10.7 Explain central control panels in signal control system 10.8 Explain Panel Interlocking 10.9 Explain solid state interlocking	Explain activities 2.1 to 2.9	Marker Board Projector Model of components of interlocking system Interlocking table Models of Relay interlocking and control panel	Identify the components of relay interlocking Identify components of Route Relay interlocking and Central control panel.	Demonstrate the principle of interlocking with the aid of simulation software Demonstrate how point at point are operated by levers Carryout field trip Carryout identification of various components of Route Relay interlocking and central control panel	Explain the principles of relay interlocking with the aid of simulation software

GENERAL OBJECTIVE 11.0 Understand Train Control Communications						
12	11.1 Explain how trains can be monitored by a signal controller 11.2 Explain block current used in communications	Explain activities 11.1 to 11.2.	Marker Board Model of Railway components on Telecommunications and radio equipment / accessories	Identify various Communication Components	Carryout identification of components in Telecommunications and radio equipment / accessories used train control communications	State the importance of telecommunications in train control.
GENERAL OBJECTIVE 12.0 Understand Railway Telephone networks						
13	12.1 Explain Railway Microwave Communications network 12.2 Explain wireless communication system 12.3 Explain Data Network	Discuss Microwave Communications network Discuss wireless communication system Discuss data network	Marker board Various network signal Microwave, Wireless and Data network trainers	Identify various communications platform in Railway system	Carryout Identification of components in railway telecommunications.	State the importance of telecommunicarions in railway signaling, e.g Global System for Mobile Railway (GSM-R)
GENERAL OBJECTIVE 13.0 Understand the Concept of Operational Signals						
14-15	13.1 Explain Hand signals 13.2 Explain fixed signals 13.3 Describe Detonating	Explain how to exhibit relevant hand signals to a driver Explain essential	White board Charts and other teaching aids Colored lamp	Use flag as signal, colored lamps/torch light at reduced visibilities Identify location of each signals in and around the	Demonstrate the use of flag colour land/touch light as signals Demonstrate the	State the importance of conventional signaling in train control mechanism.

	signals and Flares	features and working of fixed signals Describe how to use detonators and flares	Touch lights Red flags Yellow and black flags Semaphores Detonators and Flares	station Identify detonators and flares used at various distance.	use of semaphore Demonstrate the use of detonators and flares	

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: RAILWAY TRACK TECHNOLOGY 1	**COURSE CODE:** RWE 122	**UNIT: 4**	**CONTACT HOURS: 4HOURS/WEEK**
			THEORETICAL: 2HOUR/WEEK
SEMESTER: 1	**PRE-REQUISITE : NONE**		**PRACTICAL:2HOURS/WEEK**

Goal: This course is design to equip the students with adequate knowledge of a railway track.

General Objectives: On Completion of this course, the students will be able to:

1 Understand Railway track Geometry and track stresses
2 Understand the various classification of Railway gauges and the meaning of "Permanent Way" and its main components
3 Understand the basic knowledge on Rails
4 Understand the concept of rail track sleepers
5 Know the functions of railway Ballast
6 Understand the fundamentals of railway track formation and drainage
7 Know the various types of track fittings and fasteners.
8 Understand track alignment and surveying.
9 Know the working tools technicques and types of man power or labour required for track construction works. (Skilled or unskilled)

COURSE TITLE: RAILWAY TRACK TECHNOLOGY		**COURSE CODE:** RWE 122		**UNIT:** 4	**CONTACT HOURS: 4HRS/WEEKS**	
COURSE: Railway Track Technology 1					**THEORETICAL: 2HOURS/ WEEK**	
YEAR /SEMESTER : ND I/2		**PRE-REQUISITE : None**			**PRACTICAL: 2HOUR/ WEEK**	
Goals: This course is design to equip the students with adequate knowledge of a railway track.						
	GENERAL OBJECTIVE 1.0: Understand Railway track geometry and track stresses					
	THEORETICAL CONTENT			**PRACTICAL CONTENT**		
WEEK/S	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITY	RESOURCE	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITY	EVALUATION
1-2	1.1. Define Railway Track 1.2. Illustrate Railway Track Geometry 1.3. list the various components of railway track 1.4. Explain the function of various components of railway track 1.5. Explain the requirement of an ideal track. 1.6. Explain the capacity of the railway track 1.7. Explain the forces and stresses acting on the track.	Explain activities 1.1 to 1.7 to students.	White board Cart Models of railway tracks and its comonents Demonstration ground	Identify the various component of railway track and the permanent way	Carryout the identification of railway track components	Explain the function of various components of railway track
GENERAL OBJECTIVE 2.0 Understand the various classification of Railway Gauges						
3-4	1.1 Define Rail Gauges 1.2 Identify various Gauges obtainable in the world 1.3 Identify the factors affecting the choice of Rail Gauges 1.4 Identify the problem of change of gauges 1.5 Identify the Benefits of Ungauged track	Explain activities 2.1 to 2.5	White board Models of Railway tracks and its components	Identify the different rail gauges	Carryout the identification of rail gauges	State the various classification of Railway Gauges
GENERAL OBJECTIVE 3.0 Understand basic knowledge on rails.						
5-7	3.1 Define Rail 3.2 Explain the functions of Rail 3.3 List the types of Rails	Explain activates 3.1 to 3.14	White board Universal Tensile	Identify the various type of rails Carryout grade test on	Identify the various type of rails	Explain the functions of Rail

	3.4 Explain each in 3.3 3.5 List the advantages and Disadvantages of the various types of rails 3.6 Mention the Basic Requirements of an ideal rail Section 3.7 Explain design criteria of a Rail section 3.8 Explain the criteria for determining the length of rails 3.9 Explain the quality and chemical composition of Rail steel 3.10 Explain: (i) The defects in rail (ii) causes of wear (iii) measurement of wear (iii) End battered rail (iv) Effects of end batterl wear in rail (v) Wear on the sides of a rail. 3.11 Explain Rail lubricator 3.12 Explain corrugation or Roaring of Rails 3.13 Explain Buckling of Rail 3.14 Explain failure of Rail		Testing Machine (UTM) Hardness Tester	rail	Carryout the following test on rail -Tensile test -Hardness test	
GENERAL OBJECTIVE 4.0 Understand Basic knowledge on rail track sleepers						
8-9	4.1 Define a sleeper 4.2 Explain the functions of a sleepers 4.3 Discuss the Requirement of a sleeper 4.4 Explain spacing of sleepers 4.5 List classification of sleeper 4.6. Explain each in 4.5 4.6 List the merits and demerits of 4.5 4.7 Explain defects of sleeper	Explain activities 4.1 to 4.7	White board Models of Railway tracks and its components	Identify the various type of sleepers	Identify the various type of sleepers	Explain the functions of a sleepers

GENERAL OBJECTIVE 5.0 Know the functions of railway Ballast						
10-11	5.1 Define Ballast 5.2 List the functions of Ballast 5.3 Explain the characteristic of railway Ballast 5.4 Explain the types of Ballast 5.5 List the advantages and Disadvantages of the various Types of Ballast 5.6 Explain the dimension of Railway Ballast 5.7 State the comparison of different materials use as Ballast 5.8 Explain the methods of Ballast Measurements	Explain activities 5.1 to 5.8	White board Abrasion resistant testing machine Aggregate impact testing machine Metal gauge plate Sets of Sieves Enamel tray Weighing balance Aggregate	Test for physical properties of ballast	carryout the following tests: i. Aggregate Abrasion test ii. Aggregate impact test iii.Flakiness test	Explain the characteristic of railway Ballast
GENERAL OBJECTIVE 6.0 Understand the fundamentals of railway track formation and drainage						
12	6.1 Explain Railway function 6.2 Explain the function of Formation 6.3 Explain the design Aspect of the formation 6.4 Explain the execution of Earth work in embankment and cuttings 6.5 Explain blanket and its materials 6.6 Explain the function of blanket 6.7 Explain Track drainage 6.8 Identify the source of water in railway track 6.9 Explain drainage of seepage Water 6.10 Explain failure of Railway embankments (i) Explain the cause of failure (ii) Explain Remedial measure	Explain activities 6.1 to 6.10	White board Casagrande equipment Cone penetrometer Sieves and shakers	Carryout soil classification tests	carryout the following soil classification test i. Grains size ii.Consistency limit iii.permeability test	Explain the function of Formation

GENERAL OBJECTIVE 7.0 Know the various types of track fittings and fasteners						
13	7.1 Define Rail joint 7.2 List the requirement of ideal rail joint 7.3 List the Types of Rail Joint 7.4 Explain each in 7.3 7.5 Explain the requirement of an ideal fasteners 7.6 Explain: (i) fish plates (ii) Requirement of fish plate (iii) failure of fish plate 7.7 Explain the functions of the following: spike, Bolt, Chairs, Keys, Bearing plates	Explain activities 7.1 to 7.87	White board Samples of Fasteners	identify the various types of fasteners	identify the various types of fasteners	List the requirement of ideal rail joint
GENERAL OBJECTIVE 8.0 Understand Track alignment and surveying						
14	8.1 Define track alignment and Surveying 8.2 Explain the Basic Requirement of a good alignment 8.3 Explain the factors affecting Alignment 8.4 Explain survey for track Alignment 8.5 Explain Reconnaissance survey (i) instrument use /Required (ii) factors considered during Recognizance survey 8.6 Explain location survey 8.7 Explain drawing work to rail way track.	Explain activities 8.1 to	White board Theodolite Total Station Measuring tape Ranging staff Compass etc	Expose the student To the use of Basic survey equipment	Carryout simple survey using the basic survey equipment	Explain the Basic Requirement of a good alignment

	GENERAL OBJECTIVES: 9.0 Know the working tools techniques and types of man power of labour required for track construction works skilled or unskilled					
15	9.1 Define working tools 9.2 List various types of working tools use in the track 9.3 Explain the functions of each working tool 9.4 Define skilled and unskilled labour 9.5 List the types of skilled and unskilled labour required in the track 9.6 Explain the track skilled and unskilled labour e.g. length men gauger or foremen, Technical officer etc	State the functions of all the working tools and category of users.	White Board Working tools use in the track	Working tools must be seen physically from the stones	Guide students to conduct the practical	List various types of working tools use in the track

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Assignment	At least Two (2) assignment to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: ROLLING STOCK TECHNOLOGY	**COURSE CODE:** RWE 123	**CREDIT UNIT: 3**	**CONTACT HOURS: 3HOURS/WEEK**
YEAR: ONE			**THEORETICAL: 1HOUR/WEEK**
SEMESTER: TWO	**PRE-REQUISITE : NONE**		**PRACTICAL:2HOURS/WEEK**

Goal: : The course is designed to acquaint the students with knowledge of Rolling Stock

General Objectives:

On completion of this module, the students should be able to:

1.0 Understand the basic concept of Rolling stock;

2.0 Understand the power transmission in rolling stock;

3.0 Understand the braking system in rolling stock;

4.0 Understand the suspension system in rolling stock;

5.0 Understand Heating, Ventilation and Air Conditioning (HVAC) in Rolling Stock;

6.0 Understand the basic maintenance of rolling stock;

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY.**						
COURSE: ROLLING STOCK TECHNOLOGY			**COURSE CODE**: RWE 123		**CONTACT HOURS**: 3HOURS	
GOAL: THE COURSE IS DESIGNED TO ACQUAINT THE STUDENT WITH KNOWLEDGE OF ROLLING STOCK						
COURSE SPECIFICATION: **THEORETICAL CONTENT**				COURSE SPECIFICATION: **PRACTICAL CONTENT**		
Week	***Specific Learning Objectives***	***Teacher's Activities***	***Learning Resources***	***Specific Learning Objective***	***Teacher's Activities***	***Evaluation***
	GENERAL OBJECTIVE 1.0 Understand the basic concept of Rolling stock.					
1-3	1.1 Define Rolling stock 1.2 Explain the following types of Rolling stock: i. locomotive; ii. Railing car; iii. Coaches; iv. wagon, etc 1.3 Explain the components of the types listed in 1.2 1.4 Explain the train system and sub –systems 1.5 Explain the human factor requirements in rolling stock.	Explain the activities in 1.1 to 1.4. Explain how human factors are considered in rolling stock.	Marker Board; Projector; Models of rolling stocks	Identify types of rolling stock. Demonstrate influence of human factorson rolling stock.	Carry out identification of different types of rolling stock Carry out the activities in1.5	List the various types of rolling stock.
GENERAL OBJECTIVE 2.0 Understand the Power Transmission in Rolling Stock						
4-6	2.1 Define Power 2.2 Discuss power Requirement of the followings: (i) Locomotive (ii) Coaches (iii) Wagons	Explain activities in 2.1 to 2.6.	Marker board; Projector;	Demonstrate using anology of power to move train coaches, wagons and sources of fuels used.	Carryout activities in 2.1 to 2.5.	State the principle of power transmission in rolling stock.

	(iv) Rail cars 2.3 Discuss the followingSources oflocomotive power (i) Diesel – Mechanical (ii) Diesel – Electric (iii) Diesel-Hydraulic 2.4 List the essential parts of a locomotive 2.5 Explain each in 2.4 2.6 List the advantages and disadvantages of power sources in 2.3					
GENERAL OBJECTIVE 3.0 Understand Braking System in Rolling Stock						
7-8	3.1 Explain theconcept of braking system. 3.2 List the types of braking system used in a locomotives 3.3 Explain each in 3.2 3.4 Discuss the working principle of the following: (i) Compressed air brake (ii) Vacuum brake	Explain the types of braking system.	White board Models of braking system	Identify types of braking systems inrolling stock.	Demonstrate the activities in 3.4.	State the difference between compressed air and vacuum braking system in locomotives.

	3.5 Discuss the advantage in 3.4 (i & ii).					
GENERAL OBJECTIVE 4.0 Understand the suspension system in rolling stock						
9-10	4.1 Define suspension system 4.2 List the types of Suspension system in Rolling stock 4.3 Explain each in 4.2. 4.4 List the components of a suspension system in rolling stock. 4.5 Explain each in 4.4.	Explain activities in 4.1 to 4.5.	White board Projector Models of suspension system.	Identify the type ofsuspension system in rolling stock.	Carryout activities in 4.2 and 4.4.	State the functions of suspension system in rolling stock.
GENERAL OBJECTIVE 5.0 Understand Heating, Ventilation and Air Conditioning (HVAC) in Rolling Stock						
11-13	5.1 Explain the following terms in rolling stock: i. Heating ii. Ventilation iii. Air conditioning 5.2 List the different units of HVAC. 5.3 Explain each in 5.2.	Explain activities (HVAC)in 5.1 to 5.3.	White board Projector Models of HVAC.	Identify the units of HVAC	Carryout activities in 5.2.	State the effects of poor ventilation system in a locomotive.

GENERAL OBJECTIVE 6.0 Understand the Basic Maintenance of Rolling Stock						
14-15	6.1 Explain monitoring and visual check on the different types of rolling stock: (i) locomotives (ii) Railing cars (iii) Coaches (v) Wagons, etc. 6.2 Explain the types of maintenance schedules as related to the rolling stock in 6.1.	Explain how each rolling stock is maintained by monitory inspection and visual check	White board Projector Models of rolling stock.	Identify critical areas requiring maintenance.	Carry out activities of maintenance as mention in 6.2.	State the importance of maintenance in rolling stock.

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Assignment	At least Two (2) assignment to be assessed by the teacher	20
Total		100

COURSE TITLE: Technical Report Writing	**Course Code: RWE 124**	**UNIT:2**	**CONTACT HOURS: 2**
			THEORETICAL: 2 HOURS/WEEK
YEAR/SEMESTER: ND I/2nd	**PRE-REQUISITE:-None**		**PRACTICAL: 0 HOURS/WEEK**

Goal: To enable the students acquire basic knowledge of Technical Report Writing.

GENERAL OBJECTIVES: On completion of this course, the student will be able to:

1.0 Know Content of a Technical Report

2.0 Understand the information that is required in technical report writing

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: Technical Report Writing	**COURSE CODE:** RWE 124	**UNIT: 2**	**CONTACT HOURS: 2**
			THEORETICAL: 2 HOURS/WEEK
YEAR/SEMESTER: ND I/ 2nd	**PRE-REQUISITE:-**		**PRACTICAL: 0HOURS/WEEK**

Goal: To enable the students acquire basic knowledge of Technical Report Writing

GENERAL OBJECTIVE 1:0 Know Content of a Technical Report

THEORETICAL CONTENTS			PRACTICAL CONTENTS			
WK	**Specific Learning Objectives**	**Teacher's Activities**	**Resources**	**Specific Learning Objectives**	**Teacher's Activities**	**Evaluation**
1-7	1.1 Define technical reports 1.2 Identify the purpose of technical reports 1.3 Explain types and uses of technical reports 1.4 Explain the methodology and sequence of writing technical report 1.5 Preliminary sections of technical reports -Table of contents, certification page, list of Tables, list of Figures, etc. 1.6 Discuss the methods of determining the following in technical reports: -determination of topic and title - justification of title - abstract or synopsis of the report - aim and objectives of the report classification of data - scope and limitation of project - data analysis	Explain to the students activities 1.1-1.6	Lecture notes, video clips and Multimedia	-	-	-

	(graphical method, tabular method descriptive method) -Presentation of data (use of appendices) clearly - explain how it should be made and correct. 1.7 Key sections of final year project -Introduction, literature review, methodology, results & discussions, conclusions.					
	General Objective 2:0 Understand the information that is required in technical report writing					
8-15	2.1 Explain the various types of information that would be required in reports. 2.2 Determine the factors that influence solutions 2.3 Explain Railway Engineering conclusions arising from factors 2.4 Select criteria required in case studies 2.5 Determine critical analysis of case studies 2.6 Produce summary 2.7 Make propositions (Author's propositions)	Explain to the students activities 2.1-2.14.	Lecture notes, video clips and Multimedia			

	2.8 Develop conclusion to a technical report 2.9 Write references and bibliography in standard format 2.10 Explain terms of reference in report 2.11 Explain the difference between facts and opinions 2.12 Explain how facts and opinions may be distinguished in writing report 2.13 Write reports on selected technical matters 2.14 Rewrite the Abstract					

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Assignment	At least Two (2) assignment to be assessed by the teacher	20
Total		100

SEMESTER 3 ND 2

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**	COURSE CODE: **GNS 201**	UNIT: 2	TOTAL CONTACT HOURS: 2
COURSE TITLE: **USE OF ENGLISH II**			THEORETICAL:2Hours/Week
SEMESTER: 1	Pre-requisite: **-GNS 101**		PRACTICAL:0Hours/Week
COURSE MAIN AIM/GOAL: This course is designed to consolidate the student's competence in the use of English. At the end of the course the student should understand the rules and techniques of English grammar and perform well in the use of the language.			
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1. Understand the rules of grammar. 2. Write good essays. 3. Comprehend the difference between denotative and connotative uses of words. 4. Understand the techniques of comprehension and summary writing. 5. Appreciate literature in English.			

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **USE OF ENGLISH II**			COURSE CODE: GNS 201	CONTACT HOURS: HOURS		
GOAL:						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0:Understand the rules of grammar.					
1-3	1.1Define phrase. 1.2Identify the types of phrases, e.g. noun, phrase, adjectival phrase etc. 1.3Define clause. 1.4Define sentence 1.5Identify the different types of sentences e.g. simple compound, complex and compound-complex.	Explain phrase. Explain types of phrases. Explain the clause with examples. Explain sentence with examples. Explain with examples, the different types of sentences.	Text books White board Marker Projector CD	Define phrase. Identify phrases in given sentence Define the clause. Identify various clauses in given sentences. Define sentence. Identify types of sentences. construct sentences.	Assist Supervise, Guide and Correct students' activities	Class work, Assignments and Tests
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 2.0: Write good essays.					
4-6	2.1 List the different types of essay.	Explain with relevant examples the different types of essay.	Textbooks, White board, Marker, Project, CD/DVD	Define essay, list the different types of essay. Identify the features of each type of essay listed in 2.1. above. Generate/gather relevant information on a given topic. Draw up a good outline. Write a good essay on a given topic.	Assist Supervise, Guide and Correct students' activities	Class work Assignment Tests
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation

	General Objective 3.0: Comprehend the difference between denotative and connotative uses of words.					
7-9	3.1 Define the term denotation. 3.2 Explain the term connotation.	Explain denotation with examples. Explain connotation with examples.	Textbooks, White board, Marker, Project, CD/DVD	Define denotation. Identify words used denotatively. Define connotation with examples. Use words connotatively. Distinguish between denotative and connotative usage.	Assist Supervise, Guide and Correct students' activities. Provide sentences	
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0: Understanding the techniques of comprehension and summary writing.					
10-12	4.1 Define comprehension 4.2 Define summary writing	Explain the concept of comprehension. Give hints on answering questions on comprehension passages. Explain summary.	Textbooks, White board, Marker, Project, CD/DVD	Define comprehension. Answer questions on passages read. Define summary. Write within a specified length, good summary of given passages. Give contextual explanation to statements from the texts used.	Assist Supervise, Guide and Correct students' activities.	Class work Assignments Tests
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 5.0: Appreciate literature in English.					
13-14	5.1 Define drama 5.2 Explain the types of drama. e.g. comedy, tragedy, tragic-comedy farce, burlesque, opera. 5.3 Explain the terminology of drama, e.g. act, resolution, conflict, soliloquy. 5.4 Distinguish between	Explain drama with examples. Explain types of drama with examples. List the terminologies Explain the terminologies	Textbooks, White board, Marker, Project, CD/DVD	Define drama. List the types of drama. Role play. List the terminologies of drama. Explain the terminologies of drama. Give examples of the terminologies from the	Direct Demonstrate Guide Supervise Correct Produce	Class work Assignments Tests

	radio and television drama.	with examples. Explain with examples the differences between radio and television drama.		reading texts. Define radio drama. Define television drama. Discuss the characteristics of both radio and television drama. Role play Answer essay questions in a given drama text.		

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**	COURSE CODE: **EED 216**	UNIT: 2	TOTAL CONTACT HOURS: 2
COURSE TITLE: **PRACTICE OF ENTREPRENEURSHIP**			THEORETICAL:2Hours/Week
SEMESTER: 1	Pre-requisite: - **EED 126**		PRACTICAL:0Hours/Week
COURSE MAIN AIM/GOAL: **This course is designed to provide the students with the tools to carryout research projects**			

Goal: this course is designed to enable students to acquire the knowledge of entrepreneurship

General Objectives: On completion of this course, the student should be able to:

1. Understand Financial Management
2. Know how to prepare simple accounts
3. Know simple cost preparation
4. Know product and job costing
5. Understand the Laws relating to formation of Companies
6. Understand Labour and Industrial Law
7. Understand Copyright and patent laws
8. Understand the nature of sale of goods

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE TITLE: **PRACTICE OF ENTREPRENEURSHIP**		COURSE CODE: **EED 216**		UNIT: 3	CONTACT HOURS: 3HOURS/WEEK	
					THEORETICAL: 1HOURS/WEEK	
YEAR/SEMESTER: ND II/ 2		PRE-REQUISITE : NONE			PRACTICAL: 2HOUR/WEEK	
Goal: this course is designed to enable students to acquire the knowledge of entrepreneurship						
General objective 1.0: Understand Financial Management						
THEORETICAL CONTENT					PRACTICAL CONTENT	
WEEKS	SPECIFIC LEARNING OUTCOMES	TEACHER'S ACTIVITY	RESOURCES	SPECIFIC LEARNING OUTCOME	TEACHER'S ACTIVITY	RESOURCES
1	1.1 Define financial management 1.2 Explain sources and types of finding 1.3 Define the concepts of cost, price, revenue, profit and break-even point. 1.4 Explain financial statements e.g budgeting, balance sheet, profit and loss accounts, and cash flow budget.	Illustrate activities in 1.1 -1.4	Marker, Magi-board Manuals, Recommended textbooks, Lecture notes, Ropes and Chairs pulley boice.			
	General objective 2.0: Know how to prepare simple accounts					
2	2.1 Explain Dealing with assets 2.2 Prepare profit and loss statement. 2.3 Prepare balance sheet.	Illustrate activities in 2.1 -2.3	Marker, Magi-board Manuals, Recommended textbooks, Lecture notes, Ropes and Chairs pulley boice.			
	General objective 3.0: Know simple cost preparation					
3-4	3.1 Determine labour costs. 3.2 Determine direct machine cost. 3.3 Determine Overheads:	Illustrate activities in 3.1 -3.3	Marker, Magi-board Recommended textbooks, Manuals, lecture notes, etc. Dusters			

	labour, machine, and general					
	General Objective 4.0: Know product and job costing					
5-6	4.1 Explain product costing 4.2 Explain Job costing 4.3 Explain Project costing	Illustrate activities in 4.1-4.3 with diagrams and make notes where necessary	Marker, Magi-board Recommended textbooks, Manuals, lecture notes, etc. Dusters			
	General Objective 50: Understand the Laws relating to formation of Companies					
7-8	5.1 Identify the fundamental concepts in company law. 5.2 Explain memorandum and Articles of Association. 5.3 Explain promoters, promotion and the prospectus. 5.4 Distinguish between shares and debentures. 5.5 Analyse the functions and powers of Directors, Secretaries and Auditors. 5.6 Explain liquidation of companies.	Illustrate activities in 5.1-5.6 with diagrams and make notes where necessary	Marker, Magi-board Recommended textbooks, Lecture notes, Manuals, Marker, Magi-board, Duster, etc.			
	General Objective 6.0: Understand Labour and Industrial Law					
9-10	6.1 Analyse the laws relating to employer - employee relationship 6.2 Explain industrial safety laws. 6.3 Examine water and public health laws. 6.4 Evaluate land acquisition.	Illustrate activities in 6.1-6.4 with diagrams and make notes where necessary	Recommended textbooks, Lecture notes, Manuals, Marker, Magi-board , Duster, etc.			

	General Objective 7.0: Understand Copyright and patent laws					
11-12	7.1 Explain copyrights 7.2 Explain patent. 7.3 Explain rights and liabilities under the copyrights and patient laws. 7.4 Evaluate beach and remedies	Illustrate activities in 7.1-7.4 with diagrams and make notes where necessary	Recommended textbooks, Lecture notes, Manuals, Marker, Magi-board, Duster, etc.			
	General Objective 8.0: Understand the nature of sale of goods					
13-14	8.1 Define contract of sale of goods 8.2 Distinguish sale of goods from other contracts e.gbastar, hire purchase and works and materials. 8.3 Explain duties of the parties. 8.4 Explain passing of properties and titles. 8.5 Examine breach and remedies.	Illustrate activities in 8.1 - 8.5	Recommended textbooks, Lecture notes, Manuals, Marker, Magi-board, Duster, etc.			

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY	Course Code: MTH 211	UNIT: 2	Total Contact Hours:
COURSE TITLE: CALCULUS			Theoretical: 2 hours/week
Year/Semester: ND II /1	Pre-requisite:-MTH 111, MTH 113		Practical: 0 hours/week

Goal: To enable the students acquire the basic knowledge of differential and integral calculus and apply same in solving problems.

General Objectives: On the completion of the course, the students should be able to:

1. Understand the basic concepts of differential calculus and its application in solving engineering problems.
2. Know integration as the reverse of differentiation and its application to engineering problems.
3. Understand first order homogenous linear ordinary differential equations with constant coefficients as applied to simple circuits.
4. Understand the basic concepts of partial differentiation and apply same to engineering problems.
5. Understand the methods of solving second order differential equations
6. Understand Laplace transform
7. Understand double integrals and their geometric and physical application.

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY		
COURSETITLE: CALCULUS	**CODE: MTH 211**	**CH/CU: 2**
GOAL: To enable the students acquire the basic knowledge of differential and integral calculus and apply same in solving problems.		
GENERAL OBJECTIVE 1.0: Understand the Basic Concepts of Differential Calculus And Their Application In Solving Engineering Problems**.**		

	THEORETICAL CONTENT: 2 hours/week			**PRACTICAL CONTENT: 0hours/week**		
WK/S	**Specific Learning Outcome**	**Teacher Activities**	**Resource**	**Specific Learning Outcome**	**Teacher Activities**	**Resource**
1-4	1.1 Define limits with examples. 1.2 State and prove the basic theorems on limits. 1.3 Prove that $\lim_{\theta\to 0}\frac{\tan\theta}{\theta}=1$ $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$ 1.4 Define differentiation as an incremental notation of a function. 1.5 Differentiate a function from first principles. 1.6 Prove the formulae for derivative of functions, Function of a function, products, and quotient of functions. 1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions. 1.8 Derive second derivative of a function. 1.9 Apply differentiation to simple engineering and technological problems. 1.10 Explain the rate of change of a function 1.11 Explain the condition for turning point of a function. 1.12 Distinguish between	Define the limits and gives examples. Prove sine and tangent of limit to be one (1) as θ tends to zero (0). Differentiate a function from first principles. Show the formulae for derivative of functions, Function of a function, products, and quotient of functions. Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions. Explain the rate of change of a function and the condition for turning point of a function. Explain the differences between maximum and minimum value of a function.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Define the limits and give examples. Prove sine and tangent of limit to be one (1) as θ tends to zero (0). Differentiate a function from first principles. Show the formulae for derivative of functions, Function of a function, products, and quotient of functions. Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions. Explain the rate of change of a function and the condition for turning point of a function. Explain the differences between maximum and minimum value of a function. Sketch the graph of a function showing its	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	maximum and minimum value of a function. 1.13 Sketch the graph of a function showing its maximum, minimum points and points of inflexion. 1.14 Estimate error quantities from the small increment of a function. 1.15 Determine the tangent to a curve. 1.16 Determine the normal to a curve.	Sketch the graph of a function showing its maximum and minimum points and points of inflexion. Estimate error quantities from the small increment of a function. Determine the tangent and normal to a curve.		maximum and minimum points and points of inflexion. Estimate error quantities from the small increment of a function. Determine the tangent and normal to a curve.		
GENERAL OBJECTIVE 2.0: Know Integration as The Reverse of Differentiation And Its Application to Engineering Problems						
WK/S	**Specific Learning Outcome**	**Teacher Activities**	**Resource**	**Specific Learning Outcome**	**Teacher Activities**	**Resource**
5-8	2.1 Define integration as the reverse of differentiation. 2.2 Explain integration as a limit of summation of a function. 2.3 Distinguish between definite and indefinite integrals. 2.4 Determine definite integrals of functions. 2.5 Determine the indefinite integrals of a function. 2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple functions. 2.7 List the methods of integration.	Define integration as the reverse of differentiation. Explain integration as a limit of summation of a function. Explain the differences between definite and indefinite integrals. Determine definite and indefinite integrals of a function. Integrate algebraic, logarithmic, trigonometric and exponential simple functions. List the methods of integration. Integrate algebraic and trigonometric functions by	Recommended textbooks, whiteboard, graph sheets, Lecture notes, multimedia projector, and computer.	Define integration as the reverse of differentiation. Explain integration as a limit of summation of a function. Explain the differences between definite and indefinite integrals. Determine definite and indefinite integrals of a function. Integrate algebraic, logarithmic, trigonometric and exponential simple functions.	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	2.8 Integrate algebraic and trigonometric functions by substitution method. 2.9 Integrate trigonometric and exponential functions by parts. 2.10 Integrate algebraic functions by partial fraction. 2.11 Integrate trigonometric and logarithmic functions applying reduction formula. 2.12 State standard forms of some basic integrals. 2.13 Calculate length of arc, area under a curve, area between two curves, volume of revolution, centre of gravity, surface area, second moment and moment of inertia. 2.14 Define Trapezoidal and Simpson's rule as methods of approximating areas under given curves. 2.15 Find approximate area under a curve applying Trapezoidal method. 2.16 Find approximate area under a curve applying	substitution method. Integrate trigonometric and exponential functions by parts. Integrate algebraic functions by partial fraction. Integrate trigonometric and logarithmic functions applying reduction formula. List standard forms of some basic integrals. Solve length of arc, area under a curve, area between two curves, volume of revolution, centre of gravity, centre of surface area, second moment and moment of inertia. Define Trapezoidal and Simpson's rule as methods of approximating areas under given curves. Solve approximate area under a curve applying Trapezoidal and Simpson's rule. Show the students how to compare the results obtained from Trapezoidal and Simpson's rules with the results by direct integration. Apply integration to		List the methods of integration. Integrate algebraic and trigonometric functions by substitution method. Integrate trigonometric and exponential functions by parts. Integrate algebraic functions by partial fraction. Integrate trigonometric and logarithmic functions applying reduction formula. List standard forms of some basic integrals. Solve length of arc, area under a curve, area between two curves, volume of revolution, centre of gravity, centre of surface area, second moment and moment of inertia. Define Trapezoidal and Simpson's rule as methods of approximating areas		

	Simpson's rule. 2.17 Compare result obtained from Trapezoidal and Simpson's rules with the results by direct integration. 2.18 Apply integration to kinematics.	kinematics.		under given curves. Find approximate area under a curve applying Trapezoidal and Simpson's rule, and compare the results obtained with the results by direct integration. Apply integration to kinematics.		
GENERAL OBJECTIVE 3.0: Understand First Order Homogenous Linear Ordinary Differential Equations With Constant Coefficients Applied To Simple Engineering Problems						
WK/S	**Specific Learning Outcome**	**Teacher Activities**	**Resource**	**Specific Learning Outcome**	**Teacher Activities**	**Resource**
9-12	3.1 Define first order differential equation. 3.2 Explain order, degree, general solution, boundary or initial conditions and particular solution of differential equations. 3.3 Explain linear first order linear differential equation. 3.4 Define first order homogenous differential equations. 3.5 List the methods of solving differential equations by separation of variables. 3.6 Identify differential equations reducible to the	Define first order differential equation. Explain order, degree, general solution, boundary or initial conditions and particular solution of differential equations. Define linear first order linear and first order homogenous differential equations. List the method of solving differential equations by separation of variables. Identify differential equation reducible to the homogenous form. Explain and solve exact differential equations. Define integrating factors.	Recommended textbooks, whiteboard, graph sheets, Lecture notes, multimedia projector, and computer.	Define first order differential equation. Explain order, degree, general solution, boundary or initial conditions and particular solution of differential equations. Define linear first order linear and first order homogenous differential equations. List the methods of solving differential equations by separation of variables. Identify differential equations reducible to	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

	homogenous form. 3.7 Explain exact differential equations. 3.8 Solve exact differential equations. 3.9 Define integrating factors. 3.10 Determine the solution of differential equations using integrating factors. 3.11 Define linear differential equations of the first order.	Determine the solution of differential equations using integrating factors. Define linear differential equations of the first order.		the homogenous form. Explain and solve exact differential equations. Define integrating factors. Determine the solution of differential equations using integrating factors. Define linear differential equations of the first order.		
GENERAL OBJECTIVE 4.0: Understand The Basic Concepts Of Partial Differentiation And Apply Same To Engineering Problems						
WK/S	**Specific Learning Outcome**	**Teacher Activities**	**Resource**	**Specific Learning Outcome**	**Teacher Activities**	**Resource**
13-15	4.1 Define partial differentiation. 4.2 List and explain the uses of partial derivatives. 4.3 Solve problems on partial differentiation. 4.4 Apply partial differentiation to engineering problems.	Define partial differentiation. List and explain the uses of partial derivatives. Solve problems on partial differentiation relating to engineering.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.	Apply partial differentiation to engineering problems.	Correct any error in the students' definitions and concepts. Illustrate with examples. Observe, instruct and guide the students in the exercises. Supervise the students' work.	Recommended textbooks, whiteboard, Lecture notes, multimedia projector, and computer.

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	40
Total		100

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**	COURSE CODE: **SUG 208**	UNIT: 2	TOTAL CONTACT HOURS: 2
COURSE TITLE: **ENGINEERING SURVEYING I**			THEORETICAL:2Hours/Week
SEMESTER: 1	Pre-requisite: -		PRACTICAL:0Hours/Week
COURSE MAIN AIM/GOAL:			
GENERAL OBJECTIVE : 1. Understand the basic principles and scope of engineering surveying. 2. Understand the basic principles of geometric design of routes. 3. Know how to set out routes consisting of straight and circular curves 4. Understand the methods of running, calculating plotting and drawing longitudinal sections and cross sections. 5. Understand methods of area computations 6. Understand methods of volumes computations 7. Understand the process of setting out structures. 8. Understand the specialized aspects of "as built" surveys.			

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **ENGINEERING SURVEYING I**			COURSE CODE: **SUG 208**	CONTACT HOURS: HOURS		
GOAL:						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0 :Understand the basic principles and scope of engineering surveying.					
1-2	1.1 List the types and scales of plans required for constructions. 1.2 Describe the general procedure of setting out engineering works. 1.3 Describe the general procedure of "as built" surveys. 1.4 List the methods of surveying for construction. 1.5 State examples of engineering surveys where photogrammetry may be used. 1.6 Apply the uses of modern computational methods in engineering surveys. 1.7 Apply the uses of modern survey instruments in engineering surveys.	Explain activities 1.1 - 1.7 to students	OHP Charts Picture Video Maps	-	-	List the methods of surveying for construction

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 2.0: Understand the basic principles of geometric design of routes.					
3	2.1 List the types and scales of plans required for route design. 2.2 Identify the geometrical elements of routes especially roads. 2.3 Distinguish between geometric design requirements of roads, railways, pipelines, electric power lines, etc.	Explain activities 2.1 - 2.3 to students	Maps Drawings Pictures	Carryout ranging, leveling, calculations, plotting and draw longitudinal and cross-sections at 30m internal of a proposed road alignments	Guide students to conduct the practicals	Identify the geometrical elements of routes especially roads.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 3.0: Know how to set out routes consisting of straight and circular curves					
4-5	3.1 Describe the process of setting out long straight lines. 3.2 Derive mathematical relationships between circular curve elements. 3.3 Solve the problem of setting out the circular curve if there are obstructions to sighting the deflection angles. 3.4 Run through the chainage in a route comprising straight and circular curves. 3.5 Derive necessary formulae to set out circular curves by deflection angles. 3.6 Describe other methods of	Explain activities 3.1 - 3.8 to students	Total Station Theodolite	Carry out simple circle ranging.	Guide students to conduct the practicals	Describe the process of setting out long straight lines.

	setting out circular curves. 3.7 Utilise the tabulated deflection angles when occupying successive instrument stations along circular curves. 3.8 Set out a long circular curve by deflection angles using successive instrument stations.					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0: Understand the methods of running, calculating plotting and drawing longitudinal sections and cross sections.					
6-7	4.1 Describe the basic principles of sectioning. 4.2 Distinguish between longitudinal sections and cross sections. 4.3 Range and set out cross sections. 4.4 Describe the methods of leveling the longitudinal section. 4.5 Illustrate methods of booking sectional observation. 4.6 Reduce the levels of all points and plot longitudinal section and cross sections. 4.7 Explain the essential difference between the plot of longitudinal section and cross section. 4.8 Explain why in practice cross sections are usually taken at intervals. 4.9 Carry out ranging, leveling, calculation• Lecture, plotting and drawing of longitudinal section and cross sections at 30m intervals of a proposed road alignment.	Explain activities 4.1 - 4.9 to students	Theodolite, staff, total station	Carry out Tacheometric Survey of the School of Engineering.	Demonstrate the procedure for tacheometric survey	Describe the basic principles of sectioning.

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 5.0: Understand methods of area computations					
8	5.1 Distinguish between rectilinear and irregular areas. 5.2 Describe the methods of obtaining the area using formulae for geometric figures. 5.3 Use the planimeter. 5.4 Calculate areas by the trapezoidal and by Smpson's rules. 5.5 Compare the methods of area calculations.	Explain activities 5.1 - 5.5 to students	Drawing paper, Pencil, Eraser.Theodolite, level, tapes, staff.	Produce contoured plan using, theodolite along with levelling staff level with tape and staff	Demonstrate the use of theodolite in obtaining heights. Ditto using levels.	Distinguish between rectilinear and irregular areas.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 6.0: Understand methods of volumes computations					
9-10	6.1 Explain the need for calculation of volumes of earthworks. 6.2 Derive the trapezoidal and prismoidal formulae. 6.3 Calculate volumes from 6.2 above. 6.4 Calculate volumes from contour lines. 6.5 Calculate volumes from spot heights.	Explain activities 6.1 - 6.5 to students	Planimeter, drawing paper, Pencil, eraser. Calculators.	Carry out area computation of the School of Engineering with regular boundaries.	Divide area into grids of equal width. Use area method to explain the calculation using simpson, rule, and other methods including the planimeter.	Explain the need for calculation of volumes of earthworks.

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 7.0: Understand the process of setting out structures.					
11-12	7.1 Explain how setting out differs from ordinary surveying. 7.2 Describe the forms of horizontal and vertical controls needed by the setting out process. 7.3 Determine plans required for setting out. 7.4 Describe all the stages of setting out engineering structures. 7.5 Set out buildings.	Explain activities 7.1 - 7.5 to students	Planimeter, drawing paper, Pencil, eraser. Calculators.	Carry out volume computation of earth works with cut and fill and draw mass haul diagram.	Demonstrate how to obtain areas of cut and fill from cross-section. . Demonstrate the arrangement and alignment of aerial photographs to obtain a centre line of a new road.	Explain how setting out differs from ordinary surveying
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 8.0: Understand the specialized aspects of "as built" surveys.					
13-15	8.1 Explain the need for "as built" surveys. 8.2 Identify the requirements of as "built" surveys. 8.3 Carry out the methods of surveying for existing and new works as finally constructed.	Explain activities 8.1 - 8.3 to students	Planimeter, drawing paper, Pencil, eraser. Calculators.	Explain the need for "as built" surveys.	Guide students to conduct the practical	Explain the need for "as built" surveys.

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	40
Total		100

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**		
COURSE: **RAILWAY ENGINEERING DRAWING**	COURSE CODE: **RWE 211**	CONTACT HOURS: **3 HOURS**
GOAL: This course is designed to provide the student with required knowledge to be able to draw and interpret basic railway engineering drawing.		
COURSE SPECIFICATION: THEORETICAL CONTENT	COURSE SPECIFICATION: PRACTICAL CONTENT	

GENERAL OBJECTIVE :

1. Understand basic symbol for representing engineering components (civil, electrical and mechanical components)
2. Know the construction of different geometric figures and shape
3. Understand the development and intersection of regular solid and planes
4. Understand assembly drawing
5. Understand the sectioning of drawing
6. Understand site plan and draw simple site plan
7. Understand reinforced concrete structural detailing

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: Railway Engineering Drawing		**CODE:RWE211**		**Credit Unit:** 2.0		**CONTACT HOURS:**3
GOAL: This course is designed to provide the student with required knowledge to be able to draw and interpret basic railway engineering drawing						
GENERAL OBJECTIVE 1.0: Understand basic symbol for representing engineering components						
THEORETICAL CONTENT : 1 hour/week				**PRACTICAL CONTENT: 2 hours/week**		
OBJECTIVE 1.0: Understand basic symbol for representing engineering components.						
Wk	**Specific Learning Outcome**	**Teachers' Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers' Activities**	**Evaluation**
1-3	1.1 Identify the symbols for representing the following: i. Machines ii. Wiring diagrams with codes iii. Switch gear, fuses, relays etc. iv. Voltage sources and current sources. v. Semi-conductor devices. vi. Resistors, Capacitors, Inductors, Transformers. vii. Doors viii. Widow ix. Wall x. Threads xi. Screws, xii. Bolts xiii. Nuts, keys, pulleys, gears. etc 1.2 Draw the symbols in objective1.1	Draw the various components in objectives 1.1 to 1.2	Whiteboard Drawing studio	Draw basic symbol for representing various components	Guild students to carry out objective 1.2	Describe basic symbols for representing engineering components
	OBJECTIVE 2.0 Know the construction of different geometric figures and shape					
4-5	2.1 Carry out simple geometrical construction of an ellipse e.g. Tangent to an ellipse at any given point on theellipse, tangent to an ellipse from a givenpoint 'p' outside the	Draw activities in 2.1 to 2.8	Black board ruler Blackboard Tee Square Blackboard Set Squares Black board Compass Black board Protractor Adjustable set square 45° Set Square	Carry out drawing/construction in objective 1.1 to 1.8	Guide, supervise and correct students' activities.	Locate the directrix and focus of a given parabolic curve

	ellipse, etc 2.2 Divide areas of plane/figure 2.3 Enlarge and reduce from the givenareas of plane figure 2.4 Define parabola and hyperbola 2.5 Construct parabola and hyperbola using (a) Rectangular method (b) Ordinate method (c) tangent method (d) offset method. 2.6 Locate the directrix and focus of agiven parabolic curve 2.7 Construct a curve of a parabolic formthrough two given points 2.8 Define involute to a square, circle,cycloid and Archimedean spiral		60o Set square Drawing Table Pencil Desk Sharper Drawing Instrument Set Drawing Table Adjustable Set square 45o Set square 60o Set square Pencil Desk Sharpener French curve set Drawing instrument			“
	OBJECTIVE 3.0 Understand the development and intersection of regular solid and planes					
6-8	3.1 Define developments 3.2 Develop pattern of regular solids suchas truncated prism, prism, circularcylinder, truncated cylinder, frustum of apyramid, truncated cone, etc 3.3 Draw the lines of intersections of thefollowing regular solids and plane in	Explain and guild the students to carry out objectives 3.1 to 3.9	Black board ruler Blackboard Tee Square Blackboard Set Squares Black board Compass Black board Protractor Adjustable set square 45° Set Square 60o Set square Drawing Table Pencil Desk Sharper	Carry out drawing/construction in objective 3.1 to 3.9	Guide, supervise and correct students’ activities.	Define developments

	bothfirst and third angles i. a cylinder meeting asquare pyramid at rightangle ii. a cylinder meeting acone, the cone at anangle iii. a cylinder meeting acone, the coneenveloping the cylinder iv. a cylinder and a cone,the cylinder envelopingthe cone v. A Square prismmeeting a rectangularplane at an angle vi. A square prismmeeting an ellipse at anangle 3.4 Draw the patterns (developments) ofthe regular solids and planes in 3.3a-3.3e above 3.5 Draw the patterns (developments) ofthe regular solids and planes in 33f-3.3i 3.6 Draw the patterns (development ofthe regular solids and planes in 3.3j-3.3m 3.7 Make models of the patterns referredto in 3.3a - 3.3e 3.8 Make models of the pattern referredto in 3.3f - 3.3i 3.9 Make models of the pattern referredto in 3.3j -3.3m		Drawing Instrument Set Drawing Table Adjustable Set square 45o Set square 60o Set square Pencil Desk Sharpener French curve set Drawing instrument			

	OBJECTIVE 4.0 Understand assembly drawing					
9	4.1 Identify standard title-blocks for Assembly drawings. 4.2 Draw detailed drawings of machine parts using cross-referencing to show details.	Explain the activities in objective 4.1 to 4.2	White board	Draw detailed machine parts	Guide, supervise and correct students' activities.	Identify standard title-blocks for Assembly drawings.
OBJECTIVE 5.0: Understand the sectioning of drawing						
10	5.1 Explain section of drawing 5.2 Produce several section drawing.	Explain and guild to students to produce various section drawing	White board Drawing instruments	Draw section of various parts	Guide, supervise and correct students' activities.	Explain section of drawing
OBJECTIVE 6.0 understand site plan and its various types						
11	6.1 Define site plan 6.2 Lists the requirements of a site plan 6.3 List the various type of site plan 6.4 Draw the various type of site plans	Explain and guild the student to draws various types of site plans	White board marker Drawing instruments	Draw simple railway site plan	Guide, supervise and correct students' activities	Lists the requirements of a site plan
OBJECTIVE 7.0 Understand reinforced concrete structural detailing						
12-15	7.1 Explain detailing of reinforced concrete 7.2 Draw reinforced concrete details of retainingwalls, precast concrete piles, and pile caps, draft Foundation, etc.	Explain and guild the student to carry out activities in objectives 7.1 to 7.2	White board marker Drawing instruments	Draw various reinforced concrete detailing	Guide, supervise and correct students' activities.	Explain detailing of reinforced concrete

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	40
Total		100

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **RAILWAY SYSTEMS MAINTENANCE**			COURSE CODE: **RWE 212**		CONTACT HOURS: 4 HOURS	
GOAL: To train diplomates who have the knowledge and competences to perform basic Railway operational duties.						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week						
	GENERAL OBJECTIVE : On completion of this course, the student should be able to: 1. Know basic maintenance of railway systems 2. Understanding various types of rail track maintenance 3. Know various types of tools/equipment for railway track maintenance and their functions 4. Know various rail vehicle maintenance tools and equipment 5. Understanding Signaling and Communication Systems Maintenance 6. Know train station maintenance requirements 7. Know depot maintenance requirements					

PROGRMME: NATIONAL DIPLOMA (ND II) IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: RAILWAY SYSTEMS MAINTENANCE		**COURSE CODE: RWE212**		**CONTACT HOUR:4**		
GOAL: On completion of this course, the student should safely carry out the basic maintenance techniques using relevant tools and equipment in rail systems						
Semester One						
COURSE SPECIFICATION: THEORETICAL CONTENT				**COURSE SPECIFICATION: PRACTICAL CONTENT**		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objectives	Teacher's Activities	Evaluation
	GENERAL OBJECTIVES: 1.0 Know basic maintenance of railway systems					
1-2	1.1 Define railway systems maintenance 1.2 Explain various types of maintenance i.e preventive, collective etc. 1.3 Explain the advantages of maintenance. 1.4 State the implications of lack of maintenance. 1.5 Explain basic safety rules during maintenance.	Explain activities 1.1 to 1.5.	Marker boards, Safety kits and equipment, internet facilities, pictorial safety chart, projector, Training Manuals, complete set of track, track tools and accessories, special hand tools etc.	Demonstrate maintenance activities on railway track. Demonstrate safety rules and precautions in maintenance. Carry out various types of maintenance	Demonstrate various types of railway maintenance.	What is rail system maintenance. What are the types of maintenance, their advantages and implications. State various safety rules in railway maintenance.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objectives	Teacher's Activities	Evaluation
	GENERAL OBJECTIVES: 2.0 Understanding various types of rail track maintenance					
3-4	2.1 Explain various types of railway tracks.	Explain activities 2.1 to 2.4.	Marker board, Textbooks, pictorial charts,	Identify types of railway tracks, its components and defects	Display Real equipment, Real products for hands	What are the differences

	2.2 Identify components of railway tracks i.e. - Ballast - Runing rail - Sleepers etc 2.3 Explain surface defects of railway tracks and their remedial measures 2.4 Explain track maintenance activities such as changing of ballast, sleepers and running rail		Projectors equipment manuals, impact wrench, sledge Hammers.	Illustrate with diagramcomponents of rail tracks, Ballast, sleeper, and runing rail etc	on Training. Guide student to identify real equipment.	between the Ballast, Runing rail and Sleepers? What are the causes of surface defects on railway track equipment?
	GENERAL OBJECTIVES: 3.0 Know various types of tools/equipment for railway track maintenance and their functions					
5-6	3.1 Identify basic tools such as flange way cleaner, impact wrench, ballast rake, sledge hammer, claw bar, track bond drill etc and their uses. 3.2 Explain the importance of track structure and alignment(track gauging and measurement).	Explain activities 3.1 to 3.2 with sketches.	Textbooks, flange way cleaner, impact wrench, ballast rake, sledge hammer, claw bar, track bond dril, Manuals.	Draw various types of equipment for rail way track Demonstrate replacement process of rails, sleepers and ballast Illustrate gauging and measurements in track for alignment	Show various equipment used in railway track maintenance Demonstrate use of maintenance equipment and tools Organize visit to rail lines for hands on and appreciation	What are the various tools and equipment used in rail way?

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objectives	Teacher's Activities	Evaluation
	GENERAL OBJECTIVES: 4.0 Know various rail vehicle maintenance tools and equipment					
7-9	4.1 Describe maintenance of train door system 4.2 Explain maintenance of traction and brakes. 4.3 Explain the maintenance of train air conditioning system. 4.4 Identify measuringtools for: - pipe-fittings - plumbing - metal work etc. 4.5 Identify basic power tools such as: - Electric drills and hammers. - Pneumatic drills - Linear motion saws - Electric grinders etc. 4.6 Explain visual checks such as: - Scheduled service, fuelling of locomotives - Lubrication - Testing of	Explain activities 4.1 to 4.6.	Textbooks; Maintenance; Manuals; Online and offline research; Train dummy;	Carry out various rail vehicle maintenance. Use different safety wears and gadgets Carry out maintenance on a typical air conditioner system, train door, etc. Carry out typical machining process using electric drill, pneumatic drills, etc Carry out inspection of fuel level, lights, lubrication in a locomotive.	Conduct site visit to nearby railway stations, and mechanical/foundry workshop. Demonstrate activities in 4.3 and 4.4 Demonstrate the visual checks of fueling, lubricating, lighting, etc on locomotive	List any three types of power tools.

	brakes - Lighting - Oil changing.					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objectives	Teacher's Activities	Evaluation
	GENERAL OBJECTIVES : 5.0 Understanding Signaling and Communication Systems Maintenance					
10-11	a. Explain general safety maintenance of signaling and communication systems. 5.2 Identify signaling system diagrams and parts. E.g., - Train stop signal - Point signal - Train detection signal - Signal alphabets i. e a–z. 5.3 Explain maintenance of the following signaling equipment: - Train stop signal - Point signal - Train detection signal. 5.4 Explain maintenance of train warning and protection system. E.g., - Automatic Way	Explain activities 5.1 to 5.5.	Textbooks, maintenance manuals, projectors complete set of signal lights Control panel for signal control Set of complete points (switches) Track circuits Axle counters AWS/TPWS	Carry out signaling and communication systems maintenance. Carry out maintenance of signal equipment e.g., train stop signal, fault signal, etc.	Demonstrate the use of signaling system component diagrams Demonstrate the maintenance of signaling equipment, train warning,protection system, and train detection system. Visit nearby rail way station and/or railway facilities. Visit the railway operations department.	List 3 safety maintenance in signaling and communication systems. Illustrate using a simple sketch of a signaling equipment.

	System (AWS) - Train Protection Warning System (TPWS), etc. 5.5 Explain maintenance of train detection system. E.g., - Axle counter and - Track circuit, etc.					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objectives	Teacher's Activities	Evaluation
	GENERAL OBJECTIVES: 6.0 Know train station maintenance requirements					
12-13	6.1 Identify train station facilities management: - Treke dug area - Toilet - Workshop rooms - Lift - Scanners - Public address system - First aid facilities - Fire-fighting equipment 6.2 Explain maintenance facilities in 6.1: - Sanitary system maintenance - Checking/servici ng of	Explain activities 6.1 to 6.2	Textbooks, Online and offline research, Projector Building facilities Office building e.g. School office facilities, etc.	Survey train station facilities for maintenance i.e. treke dug area, lift, etc. Carry out maintenance of facilities. E.g., weekly sanitation exercise.	Visit nearby railway stations Demonstrate the use of train station facilities Demonstrate the maintenance of facilities like servicing of ticketing machines, etc.	State any four maintenance activities carried out on train station facilities.

	accessibility areas - Serving of ticketing machines, scanners, public address system etc. - Adequate and accessible functional first aid systems, fire extinguishers, etc					
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Evaluation**
	GENERAL OBJECTIVES: 7.0 To know depot maintenance requirement					
14-15	7. 1 Describe the key depot maintenance requirements. E.g., - Failure recording and data quality - Engineering team - Production team - Sourcing and supply chain team - Quality control	Explain activities in 7.1.	Textbooks, online or offline research, projector, Workshop area as depot facilities.	Carry out depot maintenance	Demonstrate typical depot maintenance. E.g., failure recording and data quality; quality control assessment.	State any key maintenance requirement carried out in a depot.

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	40
Total		100

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **RAIL OPERATIONS AND INFRASTRUCTURE MANAGEMENT**			COURSE CODE: **RWE 213**		CONTACT HOURS: 2 HOURS	
GOAL: To train students who have the knowledge and competences to perform basic Railway operational duties.						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week						
	GENERAL OBJECTIVE: **1.** Understandthe concepts of asset management in a systematic and structured manner **2.** Understand monitoring of asset conditions 3. Understand basic life insurance policies 4. Perform simple system safety measures 5. Determine system Reliability, Availability and Maintenance (RAM) 6. Understand basic system risks management on delivery of project 7. Understand human factors in operational analysis.					

PROGRMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **RAIL SYSTEM OPERATIONS AND INFRASTRUCTURE MANAGEMENT**			COURSE CODE: **RWE 213**		CONTACT HOUR:2 Hours	
GOAL: Performance of basic railway operations and manage facilities effectively						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
GENERAL OBJECTIVES 1.0: Understanding the concepts of asset management in a systematic and structured manner						
Week	Specific Learning Outcomes	Teacher's Activities	Learning Resources	Specific Learning Outcomes	Teacher's Activities	Evaluation
1-2	1.1 Define the concept of life cycle of management operations. 1.2 Explain Asset management strategies. 1.3 Explain skills and competency in management of facilities.	Explain activities 1.1 to 1.3.	Textbooks; projectors, multi-media board,	Identify various railway assets.	Conduct site visit to railway assets.	State any two railway assets management strategies.

Week	Specific Learning Outcomes	Teacher's Activities	Learning Resources	Specific Learning Outcomes	Teacher's Activities	Evaluation
	GENERAL OBJECTIVES 2.0: Understand monitoring of asset conditions					
3-5	2.1 Explain asset(s) acquisition strategy. 2.2 Explain asset maintenance strategy using condition-based and Reliability-centered maintenance. 2.3 Describe asset disposal strategies. 2.4 Explain process in Assessment of asset conditions 2.5 Explain methods used in asset maintenance measurement and monitoring. 2.6 Analyze the derivatives for continuous improvement of assets.	Explain activities 2.1 to 2.6.	Projectors, multi-media board, textbooks white board.	Analyze the derivatives for continuous improvement of assets.	Guide students to conduct the analysis.	State any three methods used in railway assets maintenance measurement and monitoring.

Week	Specific Learning Outcomes	Teacher's Activities	Learning Resources	Specific Learning Outcomes	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 3.0: Understand basic life insurance policies					
6-7	3.1 Describe the basic life insurance policieson railway facilities. 3.2 Explain asset replacement policies in railway. 3.3 Identify various obsolescence management	Explain activities 3.1 to 3.3.	projectors, multi-media board, textbooks White board,	Identify various obsolescence management	Guide students to identify various obsolescene management.	State different life insurance policies in railway facilities.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objectives	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 4.0: Perform simple system safety measures					
8-9	4.1 Explain different systemsafety management. 4.2 Explain system risk matrix. 4.3 Explain Hazard and Operability Study on Assets. (HAZOP) 4.4 Develop system safety integrity level module (SIL)	Explain activities 4.1 to 4.4	projectors, multi-media board, textbooks, White board.	Develop system safety integrity level module (SIL)	Guide students to conduct the practical.	State any two system safety manageme nt in railway.

Week	Specific Learning Outcomes	Teacher's Activities	Learning Resources	Specific Learning Outcomes	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 5.0 Determine system reliabilities, availability and maintenance (RAM) of infrastructure					
10-11	5.1 Describe RAM management. 5.2 Define Fault tolerance mean time between failures (MTBF), mean time to repair (MTTR) bathtub curve 5.3 Explain maintenance requirement analysis (MRA), Failure, modes, effects and criticality analysis (FMECA), Fault tree, event Tree. 5.4 Undertake value assessment and cost benefit analysis.	Explain activities 5.1 to 5.4.	projectors, multi-media board, textbooks white board.	Undertake value assessment and cost benefit analysis	Guide students to conduct the practical.	State any two different modes of system failures.
Week	Specific Learning Outcomes	Teacher's Activities	Learning Resources	Specific Learning Outcomes	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 6.0: Understanding basic system risk management on delivery of projects					
12-13	6.1 Define concept of risk management as applicable to: i. enterprise ii. system iii. occupation iv. project delivery	Explain activities 6.1.	projectors, multi-media board, textbooks, white board,	-	-	State the basic system risk management on delivery of projects

Week	Specific Learning Outcomes	Teacher's Activities	Learning Resources	Specific Learning Outcomes	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 7.0: Understanding Human factors on operational analysis					
14-15	7.1 Analyze the concept on ergonomics and human factor 7.2 Define operational Analysis 7.3 Define recovery analysis	Define ergonomics and show its concept in relation to human factor Explain the concept of operational analysis and recovery analysis	e-board projectors, multi-media board, textbooks marker board, and marker	-	-	Explain human factors on operational analysis

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	40
Total		100

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **INTRODUCTION TO TRAIN MOVEMENT AND CONTROL**			COURSE CODE: **RWE 214**		CONTACT HOURS: **4 HOURS**	
GOAL: To train diplomates who have the knowledge and competences to perform basic Railway operational duties.						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week						
	GENERAL OBJECTIVE : 1. Understand the concept of train movement and its control 2. Know data networks and their application to train movement. 3. Understand theprinciples of manual and automatic train operations 4. Know troubleshooting procedures and computer based maintenance. 5. Know how to manage traffic systems and practices. 6. Understand the train movement and control systems while onboard 7. Understand train movement and control standards/levels 8. Know future advancements in train movement and control systems					

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: **INTRODUCTION TO TRAIN MOVEMENT AND CONTROL**			COURSE CODE: **RWE 214**	CONTACT HOURS: **4 HOURS**		
GOAL: To train diplomates who have the knowledge and competences to perform basic Railway operational duties.						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	*Specific Learning Outcomes*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Outcomes*	*Teacher's Activities*	*Evaluation*
	GENERAL OBJECTIVE 1.0: Understand the concept of train movement and its control					
1-2	1.1 Explain the concept of train movement 1.2 Explain the components and processes involved in train movement 1.3 Explain the following types of control: - Conventional; - Computer based interlocking (CBI). 1.4 Statethe advantages of CBI over conventional control.	Explain activities 1.1 to 1.4	Training rooms with up to date computer equipment. E-Learning, white board and markers. Control panel dummy IP Camera Routers RJ45 Complete sets of tracks with crossings and switches. Signal Lights. Train dummy	Simulate train movement and its control	Demonstrate using real equipment, real products for hands on training. Real life demonstration using simulation.	What is train movement, its components and processes? What are the advantages of CBI over the conventional method of train movement control? What is train scheduling and its relationship to control?

Week	*Specific Learning Outcomes*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Outcomes*	*Teacher's Activities*	*Evaluation*
	GENERAL OBJECTIVE2.0: Know data networks and their application to train movement.					
3-4	2.1 Explain real time location of vehicles along railway track. 2.2 Explain speed as it affects control of train movement. 2.3 Explain the concept of data networks in train movement. 2.4 Explain how the data networks are used to link trains. i. Computer control units (CCUs) ii. Human Machine interface (HMIs) iii. Modular Input/output (MIO) iv. Mobile Communication Gateways (MCGs) 2.5List the functions of data network systems in train movement and its control.	Explain activities 2.1-2.5	Textbooks, Training rooms with up to date computer equipment, Whiteboard,	Demonstrate how data networks are used to link trains.	Guide the students to carry out the practicals.	State four functions of data network systems in train movement and its control.
Week	*Specific Learning Outcomes*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Outcomes*	*Teacher's Activities*	*Evaluation*
	GENERAL OBJECTIVE 3.0: Understand theprinciples of manual and automatic train operations					
5-6	3.1 Explain the difference between the principles of manual and automatic train operations in terms of the following: i. Train detection;	Explain to the student the various control systems and	Training rooms with up to date computer equipment. On and off –Line	4.1 Demonstrate on simulators automatic train operations in terms of:	simulate using control panel systems.	State the advantages/merit and disadvantages /limitations of

	ii. Movement authorization; iii. Interlocking and movement control; iv. Train Protection (TP); v. Train Operation (TO); and vi. Train Supervision (TS). 3.2 State the advantages/merit and disadvantages/limitations of manual and automatic train operations. 3.3 State the safety principles involved in manual and automatic train operations.	train movement for manual and automatic train operations mode.	E- Learning. Control panel Dummy, workshops/seminars/conferences/exhibitions.	i. Train detection; ii. Movement authorization; iii. Interlocking and movement control; iv. Automatic Train Protection (ATP) v. Automatic Train Operation (ATO); and vi. Automatic Train Supervision. 4.2 Manipulate on the simulator automatic train operations in terms of: i. Train detection;		manual and automatic train operations.

				ii. Movement authorization; iii. Interlocking and movement control; iv. Automatic Train Protection (ATP); v. Automatic Train Operation (ATO); and vi. Automatic Train Supervision (ATS). 4.3 Configure on simulators manual train operations in terms of: i. Train detection; ii. Movement authorization;		

				iii. Interlocking and movement control; iv. Train Protection (TP); v. Train Operation (TO); and vi. Train Supervision (TS). 4.4 Simulate the manual train operations in terms of: i. Train Protection (TP); ii. Train Operation (TO); and iii. Train Supervision (TS).		

Week	*Specific Learning Objectives*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Objective*	*Teacher's Activities*	*Resources*
	GENERAL OBJECTIVE 4 .0: Know troubleshooting procedures and computer based maintenance.					
7-8	4.1 Explain the principles of operation of the following: i. Multifunctional Vehicle Bus (MVB) ii. Ethernet Consist Network (ECN) iii. Wired Train Bus (WTB) 4.2 Explain the troubleshooting procedures using the principles of: i. Multifunctional Vehicle Bus (MVB) ii. Ethernet Consist Network (ECN) iii. Wired Train Bus (WTB) 4.3 Explain computer based maintenance using the principles of: i. Multifunctional Vehicle Bus	Explain the concept of troubleshooting and computer based maintenance in 5.1-5.4	Training rooms with up to date computer equipment. On and off –Line E- Learning. Training Manual, workshops/seminars/conferences/exhibitions.	5.1 Demonstrate the troubleshooting procedures using: i. Multifunctional Vehicle Bus (MVB) ii. Ethernet Consist Network (ECN) iii. Wired Train Bus (WTB)	Simulate training in a railway facilities	Explain computer based maintenance

	(MVB) ii. Ethernet Consist Network (ECN) iii. Wired Train Bus (WTB) 4.4 State the uses of the following in the computer based maintenance: i. Multifunctional Vehicle Bus (MVB), ii. Ethernet Consist Network (ECN) and iii. Wired Train Bus (WTB)			5.2 Perform troubleshooting using: i. Multifunctional Vehicle Bus (MVB) ii. Ethernet Consist Network (ECN) iii. Wired Train Bus (WTB) 5.3 Install a computer based maintenance using: i. Multifunctional Vehicle Bus (MVB) ii. Ethernet Consist Network (ECN) iii. Wired Train Bus (WTB)		

Week	*Specific Learning Objectives*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Objective*	*Teacher's Activities*	*Resources*
	GENERAL OBJECTIVE 5.0: Know how to manage traffic systems and practices.					
9-10	5.1 Define the concept of traffic management systems 5.2 Identify traffic management systems 5.3 Describe the practice of traffic management systems	Explain to the student the various traffic management systems and practices	Online research, textbook, Training rooms with up to date computer equipment, and workshops/seminars/conferences/exhibitions.	6.1 Select traffic management systems 6.2 Configure traffic management systems 6.3 Operate traffic management systems	Simulate using Computer software	Define the concept of traffic management systems
Week	*Specific Learning Objectives*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Objective*	*Teacher's Activities*	*Resources*
	GENERAL OBJECTIVE 6.0: Understand the train movement and control systems while onboard					
11	6.1 Explain the major functions of an onboard system. E.g., train protection, display of signal information to the driver, events record & audit, and monitors system status, etc. 6.2 Explain the ways which	Explain to the student the various train onboard functions and their respective principles.	Online research, textbook, Journal, workshops/seminars/conferences/exhibitions, training rooms with up to date	7.1 Select specific train onboard function. 7.2 Carry out configuration of the selected function into the computer.	Simulate using Computer software	Explain the major functions of an onboard system

	onboard system protects the train movements. E.g., compute train speed & location; manage trackside interface; compute braking profile; manage brake commands		computer equipment.	7.3 Determine the practicability of the configured function. 7.4 Understand simulation of the train onboard system functions.		
Week	*Specific Learning Objectives*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Objective*	*Teacher's Activities*	*Resources*
	GENERAL OBJECTIVE 7.0: Understand train movement and control standards/levels					
12	7.1 Identify different levels in train movement and control system using the European and Chinese standard. 7.2. Determine the equivalent train speed to each of the identified levels in 8.1.	Explain to the student the various train control levels and the approved equivalent train speed.	Online research, textbook, Journals, workshops/seminars/conferences/exhibitions, training rooms with up to date computer equipment.	8.1 Select specific level of train control 8.2 Configure the selected level into the computer 8.3 Understand the conformity of the configured level to the approved train speed.	Simulation using Computer software	
Week	*Specific Learning Objectives*	*Teacher's Activities*	*Learning Resources*	*Specific Learning Objective*	*Teacher's Activities*	*Resources*
	GENERAL OBJECTIVE 8.0: Know future advancements in train movement and control systems					
13-15	8.1 Define the concept of future train movement and control systems 8.2 Explain the future of train movement and control systems e.g.	Explain to the student the need for future concept in	On and off – Line E-Learning. Railway Journals,	7.1 Demonstrate the concept of future of train movement and control systems	Demonstrate using Computer based software	

	Computer Based Train Control (CBTC), and European Rail Train Management System (ERTMS), etc.	train movement and control technology and how the concepts will impact on rail operations.	workshops/seminars/conferences/exhibitions.	7.2 Simulate train movement and Control systems using e.g. (CBTC and ERTMS)		

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	40
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: RAILWAY SIGNALLING AND COMMUNICATIONS	**COURSE CODE: RWE 215**	**UNIT:**	**CONTACT HOURS: 4**
YEAR: TWO			**THEORETICAL:2 Hours/Week**
SEMESTER: ONE	**PRE-REQUISITE**		**PRACTICAL: 2 Hours/Week**

Goal: The course is intended to provide students with basic knowledge and skill on railway signaling and communications systems

GENERAL OBJECTIVES On completion of this course, the student will be able to:

1.0 Understand the concept and applications of signaling systems in railway industry
2.0 Understand rules, operating procedures and standards of railway signalling systems
3.0 Understand of the use of batteries and charge circuits as energy source
4.0 Know the functions and types of track circuits
5.0 Understand the operation, functions and installation of track switches

6.0: Know the principles and importance of highway crossing signal systems

7.0: Understand the operational principles and uses of Centralized Traffic Control (CTC) in railway systems

8.0: Understand the application of communication principles and systems in railway signaling

9.0: Understand the application of communication channels and radiation in railway signaling

10.0:Understand the fundamental of communication networks in railway signaling systems

11.0 Understand the operations and configuration of communication networks in railway signaling systems

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: **RAILWAY SIGNALING AND COMMUNICATIONS**			COURSE CODE: **RWE 215**		CONTACT HOURS: HOURS	
GOAL: This course is design to equip the diplomates with the skills and knowledge of Railway Signaling and Communications						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0: Understand the concept and applications of signaling systems in railway industry					
1	1.1 Explain signalling and communications in railways 1.2 Discuss evolution of signalling from mechanical through electromechanical and electrical to electronic signalling 1.3 Establish the objectives of railway signalling systems 1.4 Discuss timetable operation for spacing of trains 1.5 Discuss train order system as a signalling system 1.6 Discuss types of wayside signals: i. Light signals ii. Searchlight signals iii. Position light signals iv. Light emitting diode signals (LED) 1.7 Discuss colour light signal system 1.8 Explain the operating principles of wayside signal systems	Class discussions, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Design a timetable for train operation Operate wayside signal systems	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain signalling and communications in railways

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 2.0: Understand rules, operating procedures and standards of railway signalling systems					
2	2.1 Explain the key components of modern railway signalling systems 2.2 Discuss the rules, operating procedures and standards of railway signalling systems 2.3 Identify signalling terminology and relevant graphics 2.4 Identify factors affecting the safety and reliability of signalling systems and equipment 2.5 State the roles and responsibilities of personnel involved in railway signalling operations	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Undertake industrial visit to railway stations Write reports on industrial visits	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain the key components of modern
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 3.0: Understand of the use of batteries and charge circuits as energy source					
3	3.1 Explain the uses of battery in railway signalling 3.2 Differentiate between cell and battery 3.3 Explain the following types of battery: i. Primary/non-rechargeable; ii. Secondary/rechargeable 3.4 Discuss the application of each type of batteries in	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models,	Test the charges of battery Connect cells in parallel, serial and serial-parallel connection Perform battery charging	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain the uses of battery in railway signalling

	the railway industry 3.5 Discuss the major components of a battery: i. Plates ii. Electrolyte 3.6 Explain the process of battery charging		magazines and periodicals, software, teacher guides, laboratory manuals			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0: Know the functions and types of track circuits					
4-5	4.1Expalin the term 'track circuit' 4.2 Discuss the essential parts of track circuits in railway operations 4.3 Explain the functions of track circuits 4.4Disucss types of track circuits commonly used in railway operations 4.5 Explain the basic operation of track circuits using diagrams 4.6 Discuss the importance of train shunting of track circuit 4.7 Explain proper adjustments and components settings of track circuits 4.8 Explain automatic block signal system	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Install track circuits commonly used in railway operations Perform adjustments and components settings of track circuits	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Expalin the term 'track circuit'

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 5.0: Understand the operation, functions and installation of track switches					
6	5.1 Explain the functions of track switches 5.2 Discuss the types of track switches 5.3 Explain the operational principles of types of track switches identified in 4.2 5.4 State the sequence of operation for moving switch positions 5.5 Explain the procedure to install track switches	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Iinstall track switches Operate types of track switches	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain the functions of track switches
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 6.0: Know the principles and importance of highway crossing signal systems					
7	6.1 Explain highway crossing in signal systems 6.2 Discuss the use of locomotive whistle and bell to alert roadway traffic of an approaching train 6.3 Explain the uses of warning signals: 6.4 Discuss the operating principles of crossing circuits 6.5 Explain the working	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models,	Install warning signal system Operate automatic crossing warning device	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain highway crossing in signal systems

	principle of automatic crossing warning device		magazines and periodicals, software, teacher guides, laboratory manuals			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 7.0: Understand the operational principles and uses of Centralized Traffic Control (CTC) in railway systems					
8	7.1 Define centralised traffic control system 7.2 State the essence of centralised traffic control in railway operations 7.3 Identify the integral parts of a CTC system 7.4 Explain how train movement are authorised by CTC 7.5 Discuss the operational principles of CTC systems 7.6 Explain the following terms in CTC system: i. Dispatcher; ii. Control codes; iii. Indication codes; iv. Control points; v. Control office; 7.7 Explain the uses of computers in CTC systems to control train movement 7.8 Discuss computer software and hardware components that are used in railway signalling systems	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Perform simulation of train movement and control	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain how train movement are authorised by CTC

	7.9 Discuss sequence of operation in CTC systems					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 8.0: Understand the application of communication principles and systems in railway signaling					
9	8.1 Explain with a block diagram simple communication system showing:- a. Input transducer; b. Transmitter; c. Transmission channel; d. Receivers; e. Output transducer. 8.2 Discuss simplex, semi-duplex and full duplex communication systems 8.3 Explain the significance of analogue and digital communication systems. 8.4 Explain modulation and demodulation processes	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	-	-	Explain the significance of analogue and digital
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 9.0: Understand the application of communication channels and radiation in railway signaling					
10	9.1 Discuss frequency bands and their uses with emphasis on railway signaling systems 9.2 Explain functions of an antenna 9.3 Define the following parameters of an aerial: i. gain ii. bandwidth 9.4 Identify various types of antenna	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card,	Demonstrate the uses of the communication devices and equipment in railway signaling	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain functions of an antenna

	9.5 Explain the factors for selection of antenna and supporting structure 9.6 Explain the two major classification of communication channels i. cable; ii. broadcast 9.7 Explain the uses of the communication devices and equipment in railway signaling.	sessions	models, magazines and periodicals, software, teacher guides, laboratory manuals			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 10.0: Understand the fundamental of communication networks in railway signaling systems					
11-12	10.1 Discuss types of communication networks such as LAN, WAN, MAN, WLAN, VLAN, VPN etc 10.2 Explain the data transmission in a communication network 10.3 Identify the communication network equipment and cables 10.4 Discuss methods, tools and infrastructure used to connect internet from a computers 10.5 Discuss the physical and logical network representations of a local area networks 10.6 Explain the functions and operation of network switches and network routers	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Select the communication network equipment and cables Connect internet to a computers using wired and wireless approach Install a network switches and network routers	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Explain the data transmission in a communication network

	10.7 Explain the function and operation of a computer based interlocking devices					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 11.0: Understand the operations and configuration of communication networks in railway signaling systems					
13-15	11.1 Describe the wireless access point (WAP) 11.2 Discuss the functions of firewalls and network monitoring tools in railway signaling systems 11.3 Discuss how communication network is set up 11.4 Describe the function and basic operation essential protocols in the open systems Interconnect (OSI) and Transmission Control Protocol/Internet Protocol (TCP/IP) 11.4 Explain IPv4 and IPv6 addressing schemes 11.5 Discuss how IPv4 and IPv6 communication network addressed can be configured 11.6 Discuss communication network topology 11.7 Discuss the common troubleshooting methodologies, tools and commands for	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides, laboratory manuals	Use firewalls and network monitoring tools Perform IPv4 and IPv6 communication network configuration' Set up a simple communication network Carry out troubleshooting of communication networks	Mini-lecture, short presentation, group activities, monitoring and supervision, guidance, evaluation and assessment	Describe the wireless access point (WAP)

	communication networks					

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: ND RAILWAY ENGINEERING TECHNOLOGY		
	COURSE CODE: RWE 216	**CREDIT HOURS:** 2
COURSE: STRUCTURAL MECHANICS	**PRE-REQUISITE:**	**THEORETICAL: 2 HOURS/WEEK** **PRACTICAL : 0 HOURS/WEEK**

GOAL: To produce diplomate who understand the importance of structural mechanics

GENERAL OBJECTIVES: On completion of this course, the student should:

1.0 Know the equation of static equilibrium of structures
2.0 Understand the Kinetics of rigid bodies
3.0 Know the analytical and graphical methods of determining member forces in roof and plane frames

PROGRAMMES: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: Structural Mechanics						**CH/CU HOURS:** 2
GOAL: To produce diplomats who understand the importance of structural mechanics						
GENERAL OBJECTIVES: 1.0: Know the equation of static equilibrium of structures						
COURSE SPECIFICATION: THEORETICAL CONTENT						
	THEORETICAL CONTENT		**PRACTICAL CONTENT**			
WEEK	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**RESOURCE**	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**EVALUATION**
1-4	1.1 Define free body diagrams 1.2 Explain system of forces and types of loads (Concentrated and uniformly distributed loads) 1.3 Compute reactions moments, frictional forces and equilibrants demanded by a system in equilibrium. 1.4 Compute components of forces analytically and graphically.	Explain, computer 1.1 - 1.4 using simple models.	White board Projector.	-	-	Explain system of forces and types of loads (Concentrated and uniformly distributed loads)
	GENERAL OBJECTIVE 2.0: Understand the Kinetics of rigid bodies.					
5-9	2.1 State Newton's laws of motion. 2.2 Apply Newton's laws of motion to compute impulse, momentum and kinetic energy 2.3 Compose and resolve	Explain, computer 2.1 - 2.5 using simple models.	White board Projector.	-	-	State Newton's laws of motion.

	velocities and acceleration 2.4 Make vector representation of velocities and acceleration 2.5 Calculate relative velocity and acceleration					
GENERAL OBEJECTIVES: 3.0 Know analytical and graphical methods of determining member forces in roof and plane frames						
10-15	3.1 Determine member forces by methods of joints, sections and tension coefficients. 3.2 Repeat 3.1 above using graphical method. 3.3 Apply these methods to analyse simple planar roofs such as lattice girder, pratt and fink trusses	Explain, computer 3.1 - 3.3 using simple models.	White board Projector.	-	-	Represent forces using graphical method.

SEMESTER 4 ND 2

Programme: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**	Course Code: **GNS 202**	UNIT:	Total Contact Hours:
COURSE: **COMMUNICATION IN ENGLISH II**			Theoretical: hours/week
Year/Semester: ND II /2	Pre-requisite:- **GNS 102**		Practical: hours/week

COURSE GOAL: This course is designed to equip the student with the necessary level of competence and proficiency to enable him adapt to his professional environment. At the end of this course the student should be able to communicate clearly and effectively in both general and specific situations.

GENERAL OBJECTIVES: On completion of this course the student should:

1.0 Understand the registers.
2.0 Apply the principles of correspondence.
3.0 Apply the principles of writing for publication.
4.0 Write a report.

PROGRAMME: **NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY**						
COURSE: **COMMUNICATION IN ENGLISH II**			COURSE CODE: **GNS 202**	CONTACT HOURS: HOURS		
GOAL:						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0: Understand the registers.					
1-3	1.1Define registers. 1.2 List factors influencing register, viz., field (profession), mode (speech or writing), tenor (relationship between the interacting parties). 1.3 List some items of register peculiar to different professions. 1.4 State appropriate uses of jargon.	Explain the meaning of registers. Explain the factors that influence registers. Explain some registers found in the students' professions. Explain the use of jargons.	Textbooks Journals Internet Projector White board marker CD/DVD	Define registers. List the factors that influence registers. List some registers found in different profession. Identify registers in a given passage.	Guide, lead, supervise and assess students' activities.	Class work, Assignments and Tests.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
4-6	General Objective 2.0: Apply the Principles of Correspondence.					
	2.1 Describe different types of business letters e.g., applications, enquiries, invitations and complaints, with their replies. 2.2 Identify suitable languages for specific types of letters.	Explain the different types of business letters. Explain the language suitable for specific types of letter, with appropriate examples.	Textbooks Journals Internet Projector White board marker CD/DVD	Describe different types of business letters. Identify the suitable language for a specific type of letter. Use the identified languages to write different types business letters.	Guide, lead, supervise and assess students' activities.	Class work, Assignments and Tests.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 3.0: Apply the Principle of Writing for Publication.					

7-10	3.1 List techniques of writing for publication. 3.2 Identify published essays of literary value. 3.3 State the development of ideas in a given article.	Explain the techniques of writing for publication. Analyse published essays of literary value. Explain the development of ideas in a given article.	Textbooks Journals Internet Projector Whiteboard marker CD/DVD Magazines Newspapers	List the techniques. Identify published essays. Analyse published essays. Write essays on topical and current issues. State the stages of development of ideas. Write good articles for publication	Guide, lead, supervise and assess students' activities.	Class work, Assignments and Test
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0: Write a report.					
11-15	4.1 Define report. 4.2List the types of report. 4.3 Enumerate uses of report. 4.4 List the characteristics of a good report. 4.5Outline the stages of writing a report. 4.6 Evaluate a given report.	Explain reports. Explain the types of report. Explain the uses of report. Explain the characteristics of report e.g objectivity, style etc. Explain the stages of writing a report. Analyse a report.	Textbooks Journals Internet Projector Whiteboard marker CD/DVD	Define report. List the types of report. Mention the uses of report. Mention the characteristics of a good report. Outline the stages of writing a report. Analyse a given report. Write a report.	Guide, lead, supervise and assess students' activities.	Class work Assignments

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY	**COURSE CODE: MTH 122**	**UNIT:2**	**TOTAL CONTACT HOURS: 2HRS/WEEK**
COURSE TITLE: TRIGONOMETRY AND ANALYTICAL GEOMETRY			**THEORETICAL: 2HOURS/WEEK**
YEAR/SEMESTER: ND II/2	**PRE-REQUISITE: - MTH 111, MTH 113, MTH 114**		**PRACTICAL: - HOURS/WEEK**

Goal: This course is to enable Students understand trigonometry and analytical geometry

GENERAL OBJECTIVES

On completion of this course, the student will be able to:

1.0 Understand the manipulation of Trigonometric Formulae and equations

2.0 Understand the concept of Mensuration and its application to Engineering problems.

3.0 Understand concept of Analytical Geometry and their applications.

4.0 Know the different forms of conics such as ellipse, Parabola and hyperbola.

PROGRAMME: NATIONAL DIPLOMA IN CEMENT ENGINEERING TECHNOLOGY			
COURSE TITLE: TRIGONOMETRY AND ANALYTICAL GEOMETRY	**COURSE CODE : MTH 122**	**UNIT: 2**	**CONTACT HOURS: 2**
			THEORETICAL: 2 Hours/week
YEAR/SEMESTER: ND II /2			**PRACTICAL: - Hours/week**
Goal: This course is to enable students understand trigonometry and analytical geometry applicable to cement engineering			
GENERAL OBJECTIVES 1.0 : Understand the manipulation of Trigonometric Formulae and equations			

THEORETICAL CONTENTS			**PRACTICAL CONTENTS**			
WEEKS	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1-3	1.1 Convert sums and differences of trigonometric ratios to products: $\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A+B)}{2}$ $\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A+B)}{2}$ 1.2 Prove the sine and cosine formulae of triangles 1.3 Solve triangles using the sine and cosine formulae e.g.:- The sides a,b,c, of a triangle are 4cm, 5cm, and 6cm respectively. Find the angles. 1.4 Calculate angles of elevation and depression using trigonometric ratios e.g.:- From the top of a tree 120m high an observer sees a boat 560m away. Calculate the angle of depression. 1.5 Compute bearings, heights and distances of inaccessible objects and projections, e.g. B A man walks 3km due N, and the 3km N.52° W. How far	Illustrate with good examples activities in 1.1 to 1.10 and ask the students to solve problems on them.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes			

	is the of his starting point? What is his bearing from his original position. 1.6 Derive half angle formulae fro sin, cos and tan. 1.7 Define inverse circular function. 1.8 Explain inverse circular functions graphically. 1.9 Solve problems involving 1.8 and e.g.:- Draw the graph of 1/(cos 2θ**)**Taking values from 0^o to 90^o inclusive. 1.10 Apply the concepts in 1.8 above to three dimensional problems.					
	GENERAL OBJECTIVE 2.0**:** Understand the concept of Mensuration and its application to engineering problems.					
4-6	2.1 Explain circular measure 2.2 State the relation between radians and degrees 2.3 Prove the formulae for arc length and area of a sector. 2.4 Identify segment and chord of a circle. 2.5 Determine the area of a segment and the chord of length of a given circle. 2.6 Calculate the surface areas and volumes of simples shapes such as cylinder, sphere and cone. E.g. A solid sphere has radius 8cm.Calculate its volume. 2.7 Determine the areas and volumes of irregular shapes applying Simpsons rule. 2.8 Apply mid-ordinate rule to determine the areas and volumes applying mid-ordinate rule.	Illustrate with good examples activities in 2.1 to 2.8 and ask the students to solve problems on them.	Recommended textbooks, chalkboard, duster, chalk, lesson notes, etc			
	GENERAL OBJECTIVE 3.0 **:**Understand concept of Analytical Geometry and their applications.					

7-10	3.1 Explain two dimensional coordinate systems: Cartesian and Polar-coordinate systems. 3.2 Explain plotting and sketching of graphs w.r.t. the two coordinate systems. 3.3 Relate Cartesian coordinate to polar coordinates. 3.4 Explain the slope of a line in relation to the above concepts in 3.3. above. 3.5 Explain the intercept of a line. 3.6 Derive the formula for the gradient of line passing through two points. 3.7 Derive the equation of a straight line given the gradient and the co-ordinates of a point. 3.8 Reduce a given linear equation to the intercept form: $x/a + y/b = 1$ 3.9 Determine the coordinates of the point of intersection of two straight lines. 3.10 Define locus 3.11 Derive the slope-intercept form of the equation of a straight line: $y = mx+c$ 3.12 Derive the point B slope form of the equation of a straight line: $y - y_1 = m(x - x_1)$ 3.13 Derive the double B point form of the equations of the straight line: $y - y_1 = y_2 - y_1 \ (\underline{x - x_1})$ $x_2 - x_1$ 3.14 Derive the perpendicular form of the equation of a straight line 3.15 Solve examples of 3.11 to 3.14 above. 3.16 Find the angle (Q) between two lines whose slopes, (m_1, and m_2) are Known: $Q = \tan (m_2 \text{ B } m_1)/1 + m_1 m_2$	Illustrate with good examples activities in 3.1 to 3.26 and ask the students to solve problems on them.	Recommended textbooks, chalkboard, chalk Dusters, lesson notes etc.			

	3.17 Determine the conditions for two lines to be parallel and to be perpendicular. 3.18 Derive the expression for the perpendicular distance from a point to a line. 3.19 Draw a circle. 3.20 Derive the equation of a circle with center at the origin and radius r. 3.21 Derive the equation of a circle with center outside the origin. 3.22 State general equation of a circle. 3.23 Determine the coordinates of the center of a circle from a given equation of a circle. 3.24 Draw orthogonal circles 3.25 Find the equations of the tangent and the normal at a point circle 3.26List illustrative examples of each of 3.20 to 3.25 above					
	GENERAL OBJECTIVE 4.0 **:**Know the different forms of conics such as ellipse, Parabola and hyperbola.					
11-15	4.1 Define the Parabola 4.2 Derive the standard equation of a Parabola $y^2 = 4ax$ 4.3 State the properties of the parabola 4.4 Define the focal chord, axis and lotus rectum of the parabola 4.5 Determine the equation of the tangent and normal from a given point to the parabola. 4.6 Solve problems on parabola e.g. Write down the equation of the parabola and state its vertex if the focus B is (2,0) and the directex x = - 2. 4.7 Define and ellipse 4.8 Derive the equation of an ellipse $x^2/G^2 + y^2/b^2 = 1$	Illustrate with good examples activities in 4.1 to 4.19 and ask the students to solve problems on them.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc Drawing materials/instrument	-	-	-

	4.9 State the properties of the ellipse 4.10 Determine the equation of the tangent and the normal to an ellipse from a given point. 4.11 Define focal chord and axes of ellipse. 4.12 Solve problems on ellipses e.g. Find the length of the axes and the eccentricity for the ellipse: $4x^2 + 9y^2 = 36$ 4.13 Define the Hyperbola 4.14 Derive the equation of the Hyperbola 4.15 Identify the properties of the Hyperbola. 4.16 Define asymptotes, chord, tangent and normal to a hyperbola.4.17Solve problems on hyperbola e.g. Find the foci and directrices for hyperbola: $x^2/16$ B $y^2/9 = 1$ 4.18 Explain rectangular hyperbola 4.19 Determine tangent and normal to the rectangular hyperbola.					

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINNERING TECHNOLOGY		
COURSE TITLE:ELEMENTS OF GEO-INFORMATICS	**CODE:** GIT 201	**CREDIT HOURS:** 2 HR
YEAR: ND I	**PRE-REQUISITE**	**THEORETICAL: HOURS/WEEK**
SEMESTER :1ST		**PRACTICAL:**

GOAL: This course is designed to provide the student with the language skills which will enable him to cope effectively with the challenges of his course, to use English Language effectively in the practice of his chosen profession as well as interact with others in the society.

GENERAL OBJECTIVES:

On completion of this course, the student should be able to:

1. Understand the general concept of Geo-informatics
2. Know the hardware and software for requirements for Geo-Informatics
3. Understand the various sources of data for geo-informatics.
4. Understand the methods of data acquisition for data base creation.
5. Understand the areas of application of geo-informatics

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: **ELEMENTS OF GEO-INFORMATICS**			COURSE CODE: **GIT 201**	CONTACT HOURS: HOURS		
GOAL:						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0: Understand the general concept of Geo-informatics					
1-3	1.1 Define Geo-Informatics, map, digital mapping, map databases etc. 1.2 Explain the basic concepts of Geo-Informatic. 1.3 Explain the basic principles of digital mapping. 1.4 List the different types of digital data. 1.5 State the accuracy of each type of data.	Explain activities 1.1-1.5 to students	Computers Total station GIS, remote sensing Radar, digital photogrammetry equipment software, ILWIS Auto CADD, GIS vector, and rastar, map-info Map-Maker, DIP Arc-View, Arc-Info (Windows base) etc	Identify different types of digital data.	Guide students to conduct the practical	Explain the basic concepts of Geo-Informatic.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 2.0: Know the hardware and sorftware for requirements for Geo-Informatics					
4-7	2.1 Mention the various components of hardware for Geo-Informatics. 2.2 Explain the memory capacity required (such as RAM - 32 Mb or higher, harddisk of 1.2 ab or higher, speed of 200 MHz or higher SUGA VRAM - IMB or greater, 24 x CD drive, 3.5 drive of 1.44 Mb, etc). 2.3 Mention the various geo-informatics software e.g. CAD-Auto CAD, GIS Vector-MAP	Explain activities 2.1-2.3 to students	Charts Maps Pictures OHP Video	Identify the various geo-informatics software e.g. CAD-Auto CAD, GIS Vector-MAP INFO, GIS Raster, DIP, view (windows base) etc.	Guide students to conduct the practical	Mention the various components of hardware for Geo-Informatics.

	INFO, GIS Raster, DIP, view (windows base) etc.					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 3.0: Understand the various sources of data for geo-informatics.					
8-10	3.1 Mention different types of map (e.g topographic, thematic, digital, etc). 3.2 Mention different types of images (e.g aerial, satellite, radar, scanned aerial photos, etc). 3.3 Explain the different types of observed data (e.g theodolite, GPS, Total station, levels, hydro-phones, geo-phones, statistical etc). 3.4 Enumerate historical sources of data (e.g cadastral, history, archeological, natural resources, etc).	Explain activities 3.1-3.4 to students	Computers with suitable program	Draw and label hardware List software and use	Guide students to conduct the practical	Mention different types of map (e.g topographic, thematic, digital, etc).
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0: Understand the methods of data acquisition for data base creation.					
11-13	4.1 List the various methods of data acquisition (e.g. aerial, satellite, surveying, digitalization scanning, radar, statistical survey, etc). 4.2 Explain the procedures of 4.1 above. 4.3 Outline the specification and limitations of 4.1 above for geo-informatics requirements. 4.4 Describe the data structure and format of 4.1 above. 4.5 Explain data conversion processes. 4.6 Enumerate the procedure of	Explain activities 4.1-4.6 to students	Computers with suitable Programme	Digitize and correct maps of various scales Scan maps of various scales Produce maps, drawings and data with GIS software	Guide students to conduct the practical	Explain data conversion processes.

	data base management					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 5.0: Understand the areas of application of geo-informatics					
14-15	5.1 Mention the various areas of application of geo-informatics (e.g map revision, environmental monitoring and assessment, natural resources management, defence and security, utilities planning, engineering, population, forestry, Agriculture, Transport and Aviation, Petroleum Resources, health, education, sports development, finance, archeology etc). 5.2 Relate each of the above application to national development. 5.3 Discuss the means of achieving the above applications in Nigeria. 5.4 Enumerate if any, the obstacles that could hinder the achievement of the application of geo-informatics in Nigeria. 5.5 Explain the role of geo-informatics experts in the society.	Explain activities 5.1-5.5 to students	Computers with suitable programme	-	-	State the areas of application of geo-informatics.

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY				
COURSE TITLE: RAILWAY ECONOMICS AND PLANNING		**COURSE CODE: RWE 221**	**UNIT: 2**	**CONTACT HOURS: 2**
YEAR: TWO				**THEORETICAL: 2Hours/Week**
SEMESTER: Two		**PRE-REQUISITE**		**PRACTICAL: 0Hours/Week**

Goal: The course is intended to provide students with basic knowledge of railway economics and planning.

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

1. Understand railway business organizations and management
2. Know costs relating to railway management
3. Understand railway pricing schemes
4. Know railway revenue sources as means to sustaining the railway operations and maintenance
5. Know railway investment and its benefits to the economy
6. Know about the public demands in railway development, investment and financing
7. Understand railway contract management
8. Know railway infrastructural planning
9. Understand railway market planning.
10. Understand railway operational planning
11. Know about planning the finances of railroads

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: RAILWAY ECONOMICS AND PLANNING			**COURSE CODE: RWE 221**		CONTACT HOURS: 2 HOURS	
GOAL:						
COURSE SPECIFICATION: THEORETICAL CONTENT				COURSE SPECIFICATION: PRACTICAL CONTENT		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0 Understand railway business organisations and management					
1-2	1.1 Explain the definitions of business 1.2 Discuss different businesses that exist in the railway industry 1.3 Explain the importance of railway's mission, vision and values statements 1.4 Explain business structures and their relevance to the railway industry 1.5 State business ethics in railway industry 1.6 Discuss the basics of marketing strategies in railway industries 1.7 Explain the concepts and importance of demand and supply in railway industries 1.7 State microeconomics and macroeconomics indicators and how they affect railway industries 1.11 Explain business cycle and its effect on railway industry 1.12 Discuss market structure and its importance to the railway industries	Class discussion, Group works/activities, Case study analysis, Panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Explain the importance of railway's mission, vision and values statements

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 2.0 Know costs relating to railway management					
3	2.1 Define the term 'costs' 2.2 Discuss cost structure of railway industry 2.3 Explain the components of railway cost structure: 2.4 Identify examples of the railway cost structure discussed in 2.3 above 2.5 Discuss the following cost thresholds concept and their main uses	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Define the term 'costs'
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 3.0 Understand railway pricing schemes					
4	3.1 Define the term 'price' 3.2 Discuss the economic functions of pricing in rail transport service 3.3 Explain pricing practices and strategies for railway industry 3.4 Discuss freight pricing in railway industries 3.5 Explain passenger service pricing 3.6 Describe infrastructure	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and	-	-	Explain pricing practices and strategies for railway industry

	network access pricing 3.7 Explain the key methods of calculating tariff prices		periodicals, software, teacher guides			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0 Know railway revenue sources as means to sustaining the railway operations and maintenance					
5	4.1 Discuss the characteristics of rail passengers in Nigeria 4.2 Explain sources of revenues in railway industry 4.3 Explain fare collection systems 4.4 Define revenue management 4.5 Identify types of revenue management 4.6 Discuss the conditions for using revenue management in railway industry 4.7 Explain demand forecasting in revenue management	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Explain sources of revenues in railway industry
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 5.0 Know about the public demands in railway development, investment and financing					
6-7	5.1 Define the needs and requirements for rail investment 5.2 Identify the scope of the railway investment and its constraints 5.3 Discuss feasibility	Class discussion, Group works/activities, case study analysis, panel discussions,	Recommended Textbooks (print and digital), Laptop computers, internet resources,	-	-	Define the needs and requirements for rail investment

	studies and its objectives especially for railway investment 5.3 Explain investment options for rail investment 5.4 Discuss cost and benefit analysis 5.5 Discuss selection of most appropriate investment option for railway projects that meet the requirements 5.6 Explain risks associated with railway investment 5.7 Discuss approaches to manage risks in railway investment	questioning and feedback, active lecturing, class debate, student-led review sessions	writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 6.0 Know about the public demands in railway development, investment and financing					
8-9	6.1 Explain the social and economic benefits of railway subsidy 6.2 Discuss the challenges of railway subsidy 6.3 Define franchise contract in the railway industry 6.4 Discuss privatization, commercialization and liberalization in the railway industry 6.5 Explain the importance of regulation in the railway industry 6.6 Describe the effect of globalisation on railway industry	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Explain the social and economic benefits of railway subsidy

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 7.0 Understand railway contract management					
10	7.1 Define the term 'contract' 7.2 Distinguish between the term 'agreement' and 'contract' 7.2 Discuss elements of a valid contract 7.3 Explain the formation of contract in railway industry 7.4 Discuss the following terms: Discharge Remedies 7.5 Explain transfer asset responsibility or handing over of projects from contractors to the clients 7.6 Discuss the benefits of testing, certification and commissioning of projects	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Distinguish between the term 'agreement' and 'contract'
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 8.0: Understand railway infrastructural planning					
11	8.1 Discuss the process of planning and building of new railway projects 8.3 Explain Environmental Impact Assessment (EIA) for rail projects 8.4 Discuss the need for acquisition of rail vehicles	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing	-	-	Explain Environmental Impact Assessment (EIA) for rail projects

	for future expansion 8.5 Explain infrastructural demand and planning for future expansion 8.6 Identify factors affecting the planning and decisions of modern railway projects	lecturing, class debate, student-led review sessions	materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 9.0: Understand railway market planning					
12	9.1 Describe railway industry in the Nigerian and global markets yesterday, today and in the future 9.2 Discuss market survey, feedback and strategies 9.3 Discuss social-economic analyses of railway projects 9.4 Explain long term passenger traffic planning 9.5 Discuss case studies of some successful passenger transport projects 9.6 Explain market viability of freight traffic demand and supply	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Explain long term passenger traffic planning
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	GENERAL OBJECTIVE 10.0 Understand railway operational planning					
13-14	10.1 Explain planning techniques for railway operations 10.2 Discuss railway traffic and train services	Class discussion, Group works/activities, case study analysis, panel	Recommended Textbooks (print and digital), Laptop computers,	-	-	Explain planning techniques for railway operations

	10.3 Explain capacity condition in railway traffic 10.4 Discuss the importance of traffic forecast 10.5 Discuss plan of operation 10.6 Explain candidate and full timetables 10.7 Discuss the methods of calculating rolling stock need 10.8 Explain crew scheduling 10.9 Explain capacity demand and flow	discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides			
	GENERAL OBJECTIVES:11.0 Know about planning the finances of railroads					
15	11.1 Explain planning of incomes and profits 11.2 Describe the distribution and use of profits 11.3 Explain how to plan for levels of profitability 11.4 Explain the planning of financing of capital contruction and major over hall of basic stock 11.5 Explain the financial plan of the railroad 11.6 Explain the model of financing railway projects: 1 Private-publicership (PPP)build-operate-transfer (BOT)	Class discussion, Group works/activities, case study analysis, panel discussions, questioning and feedback, active lecturing, class debate, student-led review sessions	Recommended Textbooks (print and digital), Laptop computers, internet resources, writing materials, classrooms, memory card, models, magazines and periodicals, software, teacher guides	-	-	Explain planning of incomes and profits

	- Build-operate-transfer (BOOT) - Build and transfer (BT) 2. Engineering procurement and construction plus financing (APC-F)					

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

Programme: ND Railway Engineering Technology	**Course Code: RWE 222**	**Contact Hours: 2 – 0 - 2**
Subject/Course: Railway Track Construction		**Theory: 2 hours/week**
Year: ND II Semester: 2nd	**Pre-requisite:**	**Practical: 2 hours/week**

General Objectives

1. Identify activities preceding railway track construction.
2. Understand various types of railway tracks.
3. Know the components of various types of railway tracks and processes involved in their construction.
4. Know various railway gauges and rails
5. Know processes involved in track design and construction
6. Know various railway station equipment
7. Know track fittings and fasteners

PROGRAMME: National Diploma in Railway Engineering Technology						
Course: Railway Track Construction		**Course Code: RWE 222**		**Contact Hours: 2 – 0 - 2**		
Course Specification:		**Theoretical Content: 2hrs**		**Practical Content: 2 hours**		
Goal: Understand the principles and processes involved in railway track construction.						
Week	**General Objective 1.0: Identify activities preceding railway track construction.**					
	Specific Learning Outcome:	**Teacher Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Evaluation**
1 - 3	1.1 Explain the site activities which precede the actual construction of railway track such as route location, right of way identification, temporary works, access roads, materials storage, accommodation, site offices and conveniences. 1.2 Explain factors to be considered in site organization and layout. 1.3 Explain the process of	Explain activities 1.1 to 1.11	Instructional Manuals. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, flip charts, video clips, Theodolite, dumpy level, total station, measuring tapes. etc.	Visit a railway site and report observations. Carry out preliminary survey, reconnaissance survey, traffic survey and location survey. Carry out route survey and alignment of railway project. Carryout route survey and alignment of railway track project. Carryout setting out processes for a railway.	Arrange site visit Demonstrate route survey and alignment of railway track project. Demonstrate setting out processes for a railway.	State the preliminary processes that precede railway track construction works.

	setting out right of way using surveying instruments. 1.4 Explain the importance of Engineering Surveying in route location of railway track. 1.5 Explain how alignments, right of way, Profile levelling (cut and fill operations) are carried out. 1.6 Explain how bush clearing, felling of trees, removal of stumps are carried out. 1.7 Explain how excavations are carried out. 1.8 Explain speed and hauling of materials. 1.9 Explain the processes for the blasting of rocks.					

	1.10 Explain basic requirements of a good alignment. 1.11 Explain various factors that control the alignment.					
Week	**General Objective 2.0: Understand various types of railway tracks.**					
	Specific Learning Outcome:	**Teacher Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Evaluation**
4 - 6	2.1 List different types of railway tracks. 2.2 Explain the list railway tracks in 2.1. 2.3 Identify different types of rails. 2.4 State the advantages and disadvantages of different types of rails. 2.5 State the requirements and design criteria of an ideal railway section. 2.6 State the	Explain activities 2.1 to 2.7.	Instructional Manuals. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, flip charts, video clips, Brinell test apparatus, Rockwell test apparatus, Charpy index apparatus, etc.	Carryout quality control tests prescribed for rails i.e. Hardness test, Toughness test etc. Identify defects in rails. Identify failures of rails.	Guide the students to demonstrate quality control tests prescribed for rails i.e. Hardness test, Toughness test etc. Arrange visit to railway station.	List different types of railway tracks. State the advantages and disadvantages of different types of rails.

	criteria for determining the length of a rail. 2.7 State the qualities and chemical compositions of rail steel.					
Week	**General Objective 3.0: Know the components of different types of railway tracks and processes involved in their construction.**					
	Specific Learning Outcome:	**Teachers Activities**	**Resources**	**Specific Learning Outcomes:**	**Teacher Activities**	**Evaluation**
5 - 7	3.1 Explain the components of railway track e.g. subgrade, foundation, ballast etc. 3.2 Identify the different functional requirements of railway track components. 3.3 Explain the construction processes of sleepers and ballast. 3.4 Compare	Explain activities 3.1 to 3.5	Instructional Manuals. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, flip charts, video clips, Set of Sieves, Aggregates Crushing Strength test apparatus etc.	Perform quality control and assurance test.	Guide the students on the procedures for quality control and assurance tests.	Explain with aid of well labelled diagram any two componets of a railway track.

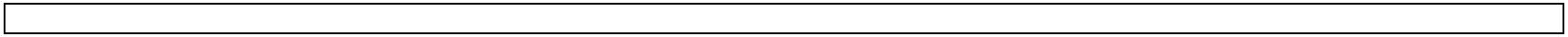
	different types of ballast. 3.5 List the maintenance requirements of different types of sleepers.					
Week	**General Objective 4.0: Know various railway gauges and rails**					
	Specific Learning Outcomes:	**Teachers Activities**	**Resources**	**Specific Learning Outcomes:**	**Teacher Activities**	**Evaluation**
8 - 9	4.1 Identifythe factors that affect gauge choice. 4.2 Explain the benefits of uni-gauge track. 4.3 Distinguish between different types of rails. 4.4 Explain the minimum rail length. 4.5Explain the criteria used to determine the length of a rail. 4.6 Explain the quality and	Explain activities 4.1 to 4.9	Instructional Manuals. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, flip charts, video clips, Railway station (for track sighting), Measuring tape, Track gauge, etc.	Determine by measurements using the following: ▪ length of rails, ▪ allowable expansion gaps, ▪ sleepers spacing, ▪ gauges, etc.	Guide the students on the use of measuring tape and track gauge.	List any two different types of railway gauges.

	chemical compositions of rail steel. 4.7 Explain the allowable variation (expansion gap) in rail dimensions. 4.8 Explain the maintenance and handling of rails. 4.9 Explain various joints in rails.					
Week	**General Objective 5.0: Know processes involved in track design and construction**					
	Specific Learning Outcomes:	**Teachers Activities**	**Resources**	**Specific Learning Outcomes:**	**Teacher Activities**	**Evaluation**
10-12	5.1 Explain functions of formation. 5.2 Explain formation width for concrete sleepers track and centre to centre distance. 5.3 Explainthe	Explain activities 5.1 to 5.7.	Instructional Manuals. Recommended textbooks, e-books, lecture notes, Whiteboard, Projector, Screen, flip charts,	Determine the volume of earthworks during track formation.	Demonstrate the use of measuring tape to determine the length of formation irrespective of terrain.	State the functions of formation

	volume of earthworks in embankments and cuttings. 5.4 Explain blanket and its materials. 5.5 Explain track dewatering or drainage. 5.6 Explain failure of railway embankments and its causes including remedial measures. 5.7 Explaingradients and various types.		video clips, measuring tape, etc.			
	General Objective 7.0: Know track fittings and fastenings					
	Specific Learning Outcomes:	**Teachers Activities**	**Resources**	**Specific Learning Outcomes:**	**Teacher Activities**	**Evaluation**
13 - 15	7.1 Explain track fitting and fastening processes in railway track laying. 7.2 State different	Explain activities 7.1 to 7.4.	Instructional Manuals. Recommended textbooks, e-books, lecture notes, Whiteboard,	Demonstrate the use of track fittings and fastenings.	Guide the students on the of track fittings and fastenings.	List five track fittings and fasteners.

	types of track fittings and fastenings. 7.3 State the functions of the items in 7.2. 7.4 State the number of track fittings and fastening per sleepers.		Projector, Screen, flip charts, video clips etc.			
ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.						

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINNERING TECHNOLOGY		
COURSE TITLE:SOIL AND ROCK MECHANICS	**CODE:RWE 223**	**CREDIT HOURS:** 3
YEAR: ND II	**PRE-REQUISITE: CEC 108**	**THEORETICAL:2 HOURS/WEEK**
SEMESTER : 2		**PRACTICAL:1 HOUR/WEEK**
GOAL: The course is designed to acquaint student with the applications of Soil and Rock Mechanics in earth resources engineering practice.		
GENERAL OBJECTIVES: On completion of this course, the student should be able to: 1. Understand the principle of compaction and its determination in the laboratory and on site. 2. Know about California Bearing Ratio (CBR) 3. General Objective: 3.0 Know Darcy's Law and permeability in soil 4. Understand Soil Stabilization 5. Know shear strength of soils and application to determination of bearing capacity 6. Understand the earth pressure theories. 7. Understand the compressibility and settlement of soils. 8. Understand the physical and mechanical properties of rock 9. Understand geo-mechanics classification of rock-masses 10. Know the applications of rock mechanics in earth resources engineering practice.		



PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY						
COURSE: **SOIL AND ROCK MECHANICS**			**COURSE CODE:RWE 223**	**CONTACT HOURS**: 3 HOURS		
GOAL: The course is designed to acquaint student with the applications of Soil and Rock Mechanics in earth resources engineering practice						
COURSE SPECIFICATION: THEORETICAL CONTENT				**COURSE SPECIFICATION: PRACTICAL CONTENT**		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 1.0: Understand the principle of compaction and its determination in the laboratory and on site.					
1-3	1.1 Explain compaction of soil. 1.2 State the different methods of compaction. 1.3 State the different forms of field control compaction characteristics. 1.4 Describe the three standard compaction tests. 1.5 Perform in the laboratory the three tests in 1.4 above 1.6 Describe a field compaction test. 1.7 Describe the type of equipment used for compaction movement of earth on site. 1.8 Explain how compaction plant is selected for different types of soils. 1.9 Explain the site compaction procedure. 1.10 Illustrate how to achieve site compaction control. 1.11 Describe field compaction tests (sand replacement and density balloon methods). 1.12 Perform field compaction tests.	Explain activities 1.1-112 to students	Projector White board Soil Sample Compaction testing machine Oven	Perform a compaction test in the laboratory to obtain the maximum Dry Density and Optimum moisture content. Conduct field density tests.	Guide students to conduct the practicals	Explain compaction of soil
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 2.0: Know about California Bearing Ratio (CBR)					
4	2.1 Explain California Bearing Ratio. 2.2 State its use in relation to design of road pavement. 2.3 Design different layers of pavement using CBR values. 2.4 Conduct C.B.R. test.	Explain activities 2.1-2.4 to students	Projector White board CBR Machine Constant and Falling head	Conduct california Bearing Ratio (CBR) test. Carry out permeability tests using constant and falling head permeameters.	Guide students to conduct the practicals	Explain California Bearing Ratio

			Permeameter Direct shear box apparatus Triaxial Machine	Carry out direct shear and triaxial compression test to obtain (C and Æ)		
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 3.0: Know Darcy's Law and permeability in soil					
5	3.1 Explain the principles of hydrostatic and excess hydrostatic pressures, and hydraulic gradient. 3.2 Explain the principles of Darcy's Law 3.3 Describe the constant head and falling head permeameters. 3.4 Perform constant and falling head permeability tests. 3.5 Describe one method of measuring the permeability of a soil in the field (pumping tests).	Explain activities 3.1-3.5 to students	White board Projector Constant and falling head Permeameter	Perform constant and falling head permeability tests	Guide students to conduct the practical	Explain the principles of hydrostatic and excess hydrostatic pressures, and hydraulic gradient.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 4.0: Understand Soil Stabilization					
6	4.1 Explain the different types of soil stabilization, (mechanical cement, lime, bitumen, etc).	Explain activity 4.1 to students	White board Projector	-	-	Explain the different types of soil stabilization, (mechanical cement, lime, bitumen, etc).

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 5.0: Know shear strength of soils and application to determination of bearing capacity					
7-8	5.1 Write the Mohr-Coulomb shear strength equation defining all term in it. 5.2 Describe and conduct direct shear test. 5.3 Describe and conduct triaxial test (Drained and Undrained) 5.4 Perform the unconfined compression test. 5.5 Evaluate shear parameters (C, Æ) given the readings from 5.2, 5.3 or 5.4. 5.6 Explain bearing capacities of soil. 5.7 Describe the applications of c and Æ to the computation of bearing capacities	Explain activities 5.1-5.7 to students	White board Projector CBR machine Direct shear box machine Triaxal machine, rubber Oedometer Stop – watch	Carry out consolidation test (settlement vs square root of time) and obtain your consolidation coefficient C_v, Also obtain your compressibility (m_v) and the compression index C_c	Guide students to conduct the practicals	Describe and conduct direct shear test.
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 6.0: Understand the earth pressure theories.					
9	6.1 Explain active and passive pressures and earth pressure rest. 6.2 Describe Rankine's earth pressure theory. 6.3 Describe Coulumb's earth pressure theory. 6.4 Evaluate earth pressure using 6.2 and 6.3.	Explain activities 6.1-6.4 to students	Projector, writing tools,	-	-	Explain active and passive pressures and earth pressure rest

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective: 7.0 Understand the compressibility and settlement of soils.					
10-11	7.1 Explain the types of settlement (immediate, consolidation and Creep). 7.2 Perform a consolidation test to determine the co-efficient of consolidation (C_v) the co-efficient of compressibility (m_v) and the compression index C_c. 7.3 Determine the amount of total consolidation settlement of a foundation using the results of 7.2.	Explain activities 7.1-7.3 to students	Projector, writing tools,	Perform a consolidation test to determine the co-efficient of consolidation (C_v) the co-efficient of compressibility (m_v) Determine the amount of total consolidation settlement of a foundation using the results of 7.2.	Guide students to carry out the practicals	Explain the types of settlement (immediate, consolidation and Creep).
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective 8.0: Understand the physical and mechanical properties of rock					
12	8.1 Explain the physical properties of rocks (e.g. hardness, density, porosity, permeability, fragility etc.). 8.2 Define the following properties of intact rock:- (tensile, compressive and shear strength; Brittle and Elastic Behavior; Isotropy and Anisotropy). 8.3 Describe the laboratory measurement of intact Rock Mechanical properties: -Uniaxial compressive strength test. -Uniaxial tensile -strength test (direct and indirect). -Triaxial compressive strength test.	Explain activities 8.1-8.5 to students	White Boards, Computers, Related Software, PowerPoint Projectors, Flip Charts, Interactive Boards, Recommended textbooks, lecture notes & Related Journals Rock testing machine Compressive testing machine	Perform laboratory test to measure mechanical properties of rock: (i) Uniaxial compressive (ii) Tensile (iii) Triaxial compressive (iv) Shear strength Perform field measurements on rocks	Demonstrate the tests to measure the mechanical properties of rock in the laboratory and in the field	Define the following properties of intact rock:- (tensile, compressive and shear strength; Brittle and Elastic Behavior; Isotropy and Anisotropy).

	8.4 Describe the methods of measuring mechanical properties in the field: a. Flat-jack measurement. b. Borehole deformation. c. Plate bearing test. d. Large scale compression and shear tests. e. Measuring bolts. (e.g. griffiths, coulombs, etc.) 8.5 Explain classical theories of rock failure (e.g. grifths, coulombs, e.t.c)		Direct shear box apparatus s Flat jack			
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective: 9.0 Understand geo-mechanics classification of rock-masses					
13	9.1 Distinguish between intact and in-situ rock strength. 9.2 Classify rock strength using the following paraments:(a) rock quality designation (RQD) (b) joint spacing.(c) intact rock strength. (d) joint conditions (gauge). (e) water.	Explain activities 9.1-9.2 to students	White Boards, Computers, Related Software, PowerPoint Projectors, Flip Charts, Interactive Boards, Recommended textbooks, lecture notes & Related Journals Rock mass strength Compass Clinometer Tape	Visit an outcrop and observe the fragmentation and joint pattern. Take measurements of joint spacing and direction foiliation e.t.c	Demonstrate how to measure joint spacing direction, folation e.t.c.	Distinguish between intact and in-situ rock strength

Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Evaluation
	General Objective: 10.0 Know the applications of rock mechanics in earth resources engineering practice.					
14-15	10.1 Define the following terms: (a) factor of safety (b) radial stress (c) circumferential stress (d) total stress (e) displacement. 10.2 Derive formulae, where appropriate, for the terms in 10.1 above. 10.3 Explain how the terms in 10.1 are used in designing underground openings. 10.4 Define tailings dams. 10.5 Explain the importance of 10.4 above. 10.6 Describe the procedure for choosing site for tailings dams. 10.7 Describe various designs of tailing dams (e.g. upstream, downstream, types of foundations). 10.8Explain the subsidence phenomenon.	Explain activities 10.1-10.8 to students	White Boards, Computers, Related Software, PowerPoint Projectors, Flip Charts, Interactive Boards, Recommended textbooks, lecture notes & Related Journals	-	-	Describe the procedure for choosing site for tailings dams.

Assessment:

Type of Assessment	Purpose and Nature of Assessment	Weighting (%)
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY	COURSE CODE: **RWE 224**	UNIT:	TOTAL CONTACT HOURS: 5HRS/WEEK
COURSE TITLE: **STRENGTH OF MATERIALS**			THEORETICAL: 2HOURS/WEEK
YEAR/SEMESTER: ND II/2	PRE-REQUISITE: - MEC 111, MEC 124		PRACTICAL: 3 HOURS/WEEK

Goal: This course is to enable Students understand various types of stress & strain, shearing force & bending moments, shear stress, torque in circular shafts, temperature stresses and second moment of area.

GENERAL OBJECTIVES: On completion of this course, the student will be able to:

1. Understand various types of stress and strain
2. Understand the construction of shearing force and bending moment diagrams and the computation of shearing force and bending Moment
3. Know Shear Stress and Torque in Circular Shaft
4. Understand the Use of Mohr's Circle
5. Know composite bar and Temperature stresses
6. Understand bending stresses and second moment of area

PROGRAMME: NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY			
COURSE TITLE: STRENGTH OF MATERIALS	**COURSE CODE : RWE 224**	**UNIT: 5**	**CONTACT HOURS: 5**
			THEORETICAL:2 Hours/week
YEAR/SEMESTER: ND II /2			**PRACTICAL: 3 Hours/week**

Goal: This course is to enable Students understand various types of stress & strain, shearing force & bending moments, shear stress, torque in circular shafts, temperature stresses and second moment of area.

General Objective 1.0 : Understand Various Types of Stress and Strain

THEORETICAL CONTENTS			**PRACTICAL CONTENTS**			
WEEK	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITIES**	**EVALUATION**
1-3	1.1 Define Stress and Strain 1.2 Give the type of stresses and strains 1.3 Differentiate between the following: • Tensile; and • Compressive stress 1.4 State Hooke's law 1.5 Draw and explain stress and strain curves for :brittle and ductile materials 1.6 Describe strength properties of some engineering materials.	Explain in details direct stress and strain.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes Springs, loads modulus of rubber apparatus etc.	Verify Hooke's law using spring and dead weight Conduct tensile tests and compression tests on ductile and brittle materials. Conduct Izod and Charpy tests on different materials And Brinell hardness test.	Demonstrate activities in 1.1, 1.2, 1.3 and 1.4 for the students to learn and ask them to carry out all the activities.	Define Stress and Strain

	General Objective 2.0: Understand the Construction of Shearing Force and Bending Moment Diagrams and The Computation of Shearing Force and Bending Moment					
4-6	2.1 Define shearing force and bending moments. 2.2 Beam 2.3 Type of beams and loads 2.4 sign convention for shear force and bending moment 2.5 Write expression for shear force and bending moment at a section of a loaded beam. 2.6 Calculate the point of contraflexure. 2.7 Calculate the neutral axis, the second moment of area of section, the moment of resistance.	Explain shear force and bending moment in detail and derive an expression to draw the shear and bending moment at a section.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes Springs Young modulus apparatus etc.	Identify different types of beam. Analyze simply supported beams with concentrated loads Perform experiment on young modulus using metal rod	Demonstrate 2.2 to 2.3 to students and let them carry it out	Define shearing force and bending moments.

	General Objective 3.0 : Know Shear Stress and Torque in Circular Shaft					
7-8	3.1 Define shaft 3.2 List materials used for shafts 3.3 List types of shafts 3.4 Know requirement for design of shafts 3.5 Derive an expression for torsion of Circular shafts : Solid and hollow shafts Solve problems related to 3.1 angles of twist, torsional stress, torque etc.	Explain torsion and derive an expression for the torsion of a circular shaft. Solve problems relating to shear stress. angle of twist and torque in circular shafts	Recommended textbooks, chalkboard, chalk Dusters, lesson notes etc. Torsion test apparatus	2.1 Conduct torsion test. 2.2 Investigate the whirling speed of an unloaded shaft with fix-fixed ends.	Demonstrate all the activities for the students to learn and ask them to carry out all the activities	List materials used for shafts
	General Objective 4.0 : Understand the Use of Mohr's Circle					
9-10	4.1 Define mohr's circle 4.2 Know how to use mohr's circle to determine principal stresses and the plane in which they occur	Explain in details the application of mohr's circle and how to use mohr's circle to solve basic problems.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc Drawing materials/instrument	-	-	Define mohr's circle
	General Objective 5.0: Know Composite Bar and Temperature Stresses					
11-12	5.1 Define composite bar 5.2 Define temperature stresses 5.3 Derive an expression for 5.1 and 5.2 above 5.4 Solve basic problems related to 5.1 and 5.2	Explain composite bar and temperature stresses with working examples.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc Drawing materials/instrument	-	-	Define composite bar

	General Objective 6.0: Understan bending stresses and second moment of area					
13-15	6.1 Define center of gravity 6.2 Define centroid 6.3 Differentiate between 6.1 and 6.2 6.4 Explain Bending Stresses 6.5 Derive an expression for pure bending of a rectangular beam , position of neutral axis and moment of resistance 6.6 Explain second moment of area 6.7 Explain the parallel axis theorem 6.8 solve basic problems on 6.1. 6.9 Determine the second moment of area the neutral axis.	Explain 6.1 to 6.7 in details with aid of diagrams, working examples and adequate notes.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc Drawing materials/instrument	-	-	Explain second moment of area

Assessment:

Type of Assessment	**Purpose and Nature of Assessment**	**Weighting (%)**
Examination	Final examination (written) to assess knowledge and understanding	60
Test	At least Two (2) progress tests for feedback.	20
Practical	At least Five (5) works to be assessed by the teacher	20
Total		100

MINIMUM RESOURCES REQUIRED FOR NATIONAL DIPLOMA IN RAILWAY ENGINEERING TECHNOLOGY PROGRAMME

S/N	Laboratory	Workshop	Studio	Field
1	**Railway Signalling/Telecommunication**	**Railway Maintenance**	**Drawing**	**Rail track**
2	**Basic Electricity, Measurement and Instrumentation**	**Machanical**	**Survey Store**	
3	**Strength of Materials**	**Concrete/Block-laying**		
4	**GIS**			
5	**Materials Science**			
6	**Soil Mechanics**			

LABORATORIES

RAILWAY SIGNALING AND TELECOMMUNICATIONS

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	Railway Signals training system	2
2	Train Simulator Model	2
3	Computers for Simulation	30
4	Train Simulator software	Assorted
5	Analog Communication training system	2
6	Digital Communication training system	2
7	Optical Fibre Communication training system	2
8	Analog-Digital signal conversion training system	2
9	Digital-Analog signal conversion training system	2
10	Digital Storage Oscilloscope	2
11	Function Generator	2
12	DC Power Supply Unit	2
13	Digital Multimeter	10
14	Fixed telephone training system	2
15	Wireless telephone training system	2
16	Radio communication training system	2
17	Electric Symbols	Assorted
18	Multimeters	5
19	AC Device	2
20	Galvamometer	5
21	Generator	2
22	Resistors, Capacitors, Inductors	Assorted
23	Ignition coil	2
24	Semaphore devise	2
25	Disc devise	2
26	Colored light devise	2
27	Lever chart	2

28	Model of Components of Interlocking System	2
29	Interlocking table	2
30	Model of relay interlocking and control panel	2
31	Model of Railway components on telecommunications and radio equipmet/accessories	2
32	Microwave wireless and data network trainers	2
33	Colored lamp	2
34	Touch light	2
35	Detonator	Assorted
36	Flare	2
37	Control panel dummy	1
38	IP camera	2
39	Routers	2
40	RJ45	2
41	Complete sets of tracks with crossing and switches	1
42	Signal lights	2
43	Train dummy	1
44	Complete set of signal light	1
45	Control panel for signal control	1
46	Set of complete points (switches)	Assorted
47	Traffic signs	Assorted
48	Red/Yellow/Black Flags	Assorted
49	Sound level meter	1
50	Niose dosimeter	1
51	Fire extinguisher	2
52	Personal Protective Equipment	10 set
53	Sand bucket	2
54	Safety posters	Assorted

BASIC ELECTRITY/MEASUREMENT AND INSTRUMENTATION LABORATORY

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	Basic Electricity Kit	10
2	Ammeters (Various ranges) 0- 25A DC 0- 2 A AC	 10 10
3	Milliammeter 0 1000mA DC 0- 1000mA AC	 10 10
4	Micrometer 0- 1000mA DC 10- 1000mA AC	 10 10
5	Voltmeter 0- 500V DC 0- 500V AC	 10 10
6	Millivoltmeter 0- 1000mV DC	 10
7	Variac	5
8	Ohmmeter 0- 5 ohms 0- 25 ohms 0- 50 ohms (Multirange)	 10 10 10
9	Galvanometer (triple range) 50-0-50mA 500-0-500mA 5-0-5 mA	 10 10 10
10	Wattmeter Single phase Three phase	 5 5
11	Megger tester	5
12	Wheatstone Bridge	5
13	Potentiometer	5

14	Electronic Trainer Units	5
15	RC Oscillators	5
16	Experimental Trainer for AC and DC	2
17	Rheostats (Various ranges)	20
18	Earth-loop tester	5
19	Fire Extinguisher	1
20	Sand and water buckets	1

STRENGTH OF MATERIALS/STRUCTURES LABORATORY

S/N	DESCRIPTION OF ITEM S	QUANTITY
1	Springs	3
2	Loads	Assorted
3	Two hinged and Three-hinged arch apparatus	1
4	Continuous beam apparatus	1
5	Deflection of beams apparatus	1
6	Bending moment and shearing force apparatus	1
7	Elastic beam apparatus	1
8	Elastic deflection of frames	1
9	Strut buckling apparatus	1
10	Torsion testing machine	1
11	Modulus of rubber	1
12	Young Modulus Apparatus	1
13	Rock testing machine	1
14	Direct shear box apparatus	1
15	Flat Jack	1

SOIL MECHANICS LABORATORY'

S/N	DESCRIPTION OF ITEM S	QUANTITY
1.	C.B.R. Apparatus	1
2.	Consistency limits test apparatus	6
3.	Compacting factor machine	1
4.	Compacting core machine	1
5.	Particle size distribution test apparatus (manual and electrical –sieve shaker)	2 set
6.	Compaction test apparatus	3 standards
7.	Core Penetrometer	1
8.	Moisture content test apparatus	2
9.	Specific gravity test apparatus	3
10.	Density test apparatus	3
11.	Le Chatelier test apparatus	2
12.	Augers and rings with sampling & extruding devices	5
13.	V-b Consistometer test apparatus	1
14.	Drying ovens	3
15.	Sampling collecting trays and sample containers	20
16.	150mm cube moulds	18
17.	150mm cylindrical moulds	18
18.	Balances e.g. analytical balance triple beam Balance, top pan-balance, semi-automatic Balance, spring balance, chemical balance, electrical balance	1
19.	Vicat apparatus	2 of each
20.	Thermometers	2
21.	Measuring cylinders	5 of each
22.	Cement fineness test apparatus	5
23.	Soil hydrometers	2
24.	Crucibles, spatulas, funnels	3
25.	Desiccators	5
26.	Curing tank	6
27.	Stop watches	1
28.	Beam moulds	10

29.	Crushing machine	4
30.	Vernier calipers	1
31.	Glass wares	2
32.	SchudtRebounce Harmers	2
33.	Geological maps	Assorted
34	DEMIC Gauge	2
35	Casagrande Equipment	1
36	Enamel Tray	2
37	Constant and falling head permeameter	1
38	Oedometer	1

MATERIALS SCIENCE LABORATORY

S/N	DESCRIPTION OF ITEM S	QUANTITY
1.	Universal Tensile Testing Machine (UTM)	1
2.	Floor mounted tensile/compression testing machine, 40KN capacity with accessories	1
3.	Rotary fatigue testing machine with accessories	1
4.	Torsion testing machine (50NM) with accessories	1
5.	Hardness Tester	1
6.	Abrasion Resistant Testing Machine	1
7.	Strain gauge apparatus	1
8.	Aggregate Impact Testing Machine	1
9.	Polishing Machine	2
10.	Metallurgical microscope with USB for PC picture processing	3
11.	Etching machine	2
12.	Specimen mounting screen	2
13.	Table top tensometer with accessories	1
14.	Desiccators	2
15.	Parting machine	1
16.	Abrasive cutters	2
17	Fire extinguisher and sand buckets	2 each

WORKSHOPS

RAILWAY MAINTENANCE WORKSHOP

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	Rail (Running Rail)	20 Metres
2	Running Rail Components	100
3	Automatic Warning System (AWS) Magnet (Yellow and Green)	2
4	AWS components	10
5	Axles Counter Mushroom	2
6	Axles counter Head	2
7	Ground Signal/Accessories	2
8	Banner Repeater (Signal)	2
9	Signals and Poles	3
10	Signal Cables and Accessories	20
11	Point Machines/Accessories	2
12	Point Components	10
13	Control Panel/Accessories	2
14	Control panel Monitor	2
15	Rail drilling Machine	2
16	Rail Cutting Machine	2
17	Railway Crimping Tools	2 packs
18	Relays	Assorted
19	Relays Components/Accessories	Assorted
20	Location Cases/Accessories	4
21	Tool Box	6
22	Train ProtectionWarningSystem (TPWS)	2
23	TPWS Components	Assorted
24	Track Ballast	Assorted
25	Train Model (Locomotive)	1
26	Train Model (Rolling stock)	1
27	Power Hand Tools	Assorted

28	Rail Track Measurer	1
29	Track Tools and Accessory	Assorted
30	Electrical consumables	Assorted
31	Tunnel and Culverts Models	1
33	Wheels and Traction Tires	1
34	Building/Structures models	1
35	Bridges models	1
36	Snap Tracks and Track Packs	2
37	Signals Testing Equipment	Assorted
38	Telecommunications and Radio Equipment/Accessories	Assorted
39	Transformer for location cases	4
40	Rail Testing Equipment	1
41	Model of Rolling Stock	Assorted
42	Model of Braking System	Assorted
43	Model of Suspension System	Assorted
44	Model of HVAC (heat, ventilation and air conditioning)	Assorted
45	Complete set of track	1
46	Track tools and accessories	2
47	Impact wrench	2
48	Sledge Hammer	2
49	Flange way cleaner	2
50	Ballast rake	2
51	Claw bar	1
52	Track bond dril	2
53	Track circuit	2
54	Axle counters	2
55	AWS/TPWS	2
56	Personal Protective Equipment	10 set

MECHANICAL WORKSHOP

S/N	DESCRIPTION OF ITEMS	QUANTITY
1	**Drill Press**	
i.	Pillar drilling machine	1
ii.	Bench drill machine	1
iii.	**Accessories**	
iv.	(i) drill sets in boxes	4
v.	(ii) drills 1/16"x 1/2"	4
vi.	(iii) drills 1mm	4
vii.	(i) Cluck keys – spare	4
2	**Shaping/Planning Machine**	
i.	Shaping machine	1
ii.	Planning machine	1
3	**Guillotines**	
i.	Gabro type guillotine/Notches 4M	1
4	**Lathes**	
i.	Bench lathe Model	1
5	**Riveter**	

i.	Riveting machine	1
6.	**Saw**	
i.	Power hacksaw (metal cutting machine) with accessories	1 unit
7	**Welding/Fabrication Equipment**	
i.	Electric Unit with accessories	2
ii.	Gas Unit with accessories	2
iii.	Welding beds	2
iv.	Brazing equipment	2
v.	Brazing rods	2
vi.	Soldering rods	2
vii.	Soldering Flux	2
viii.	Safety goggles	2
ix.	Wire Bruch	2
x.	Chipping Hammer	2
xi.	Blow Lamp	2
xii.	Welding Tables	4
xiii.	Anvil	1

8	**Pliers**	
i.	Engineers Combination 6"	6
ii.	Multi-groove 10"	6
iii.	Needle use 6"	6
iv.	Vice grip 10"	6
v.	Slip joint 8"	6
vi.	Diagonal cutting 8"	6
vii.	Long nose 6"	6
viii.	Side cutting	6
9	**Punches**	
i.	Centre punch 6"x 1/8"	5
ii.	Drift punch 16"	5
iii.	Drive pin punch	5
iv.	Starting punch	5
10	**Screw Driver**	
i.	Standard .tip l/4"x 4"	5
ii.	Standard tip 5/16"x 16"	5

iii.	Offset straight tip 1 and 2	5
iv.	Straight tip spring clip	5
11	**Spanners**	
i.	BSW Spanner and Wrench	5
ii.	Open-ended Spanner Sets British Whitworth set Metric set	5
iii.	Ring Spanner sets:	5
iv.	Miniature Spanner sets:	5
v.	Socket spanner set 1/2" drive	5
12	**Files**	
i.	Bastard 8" (flat, half round, square, round)	5
ii.	Cabinet 8" (flat smooth, 1/2 round smooth, 1/2 round second cut, round second cut).	5
iii.	Flat 8"(second cut, smooth)	5
iv.	Half round 8' (second cut, smooth) 5. Square 8" (second cut, smooth)	5
v.	Handles size 2 to fit above	10
vi.	Needle file set	10
13	**Micrometers**	
i.	Three sizes (capacities 0-1", 0-2", 0-3" outside set, inside set)	6

14.	**Rules**	
i.	Flexible stainless steel l' rule graduated \n metric one side and 1/8, 1/16, 1/32 on reverse	10
ii.	Heavy duty punch/pull graduated metric/imperial 16ft with locking mechanism	10
15	Workbench/Bench Vice	10/20
16	Hammer/Gauges/Chisels	Assorted
17	Hand Grinder	2
18	Pedestal Grinder	1
19	Plumbs Level, Dumpy Level, Concrete Mixer, Batching Boxes, Water Trowel, Float, Square Spirit Level	4 each
20	Safety equipment	Assorted
21	Fire Extinguisher/sand buckets	2 each

SURVEY STORE

S/N	DESCRIPTION OF ITEMS	QUANTITY
1.	Leveling Instruments	1 each
2.	Theodolite	2
3.	Compasses with tripods	3
4.	Mirror Stereoscope (HND)	3
5.	Pantograph	2
6.	Staves	5
7.	Ranging Poles	20
8.	Surveying Umbrella	6
9.	Chains	5
10.	Steel arrows	15
11.	Planimeters	3
12.	Tapes(30m, 50m, 100m)	4 each
13.	Optical square	3
14.	Pocket altimeter	2
15.	Steel band	3
16	Total Station	2
17	EDM	1
18	Clinometer	1

Concrete/Block-laying Workshop

S/N	ITEM	NUMBER REQUIRED
1.	Portable compressor and accessories	1
2.	Bar bending machine	1
3.	Steel cutter	1
4.	Mesh/BRC cutter	1
5.	Concrete vibrator: poker and table vibrators	1
6.	Hand rammers	4
7.	Concrete portable mixer (at least 2 cu. Ft. capacity)	1

8.	Brick/block making machine	1
9.	Wheel barrow	5
10.	Watering can	5
11.	Shovels	15
12.	Head pan	10
13.	Brick saw	1
14.	Concrete nail gun	1
15.	Hand tools, e.g. spirit levels, trowels, hammers, rules, squares, mallet, tapes, floats etc.	Assorted
16.	Multiflow mixer	1
17.	Cement box	5
18.	Aggregates and sand box	5
19.	Slump cones	5
20.	Concrete crushing machine	1

STUDIOS

A. COMPUTER STUDIO

S/N	**DESCRIPTION OF ITEM S**	Quantity
1	Computers	30
2	Industrial Printers	2
3	Tables and Chairs	30
4	Different Types of Software	Assorted
5	Magi-board and Marker	1
6	Projector	1

B. DRAWING STUDIO

S/N	**DESCRIPTION OF ITEM S**	QUANTITY
1	Drawing table complete with drafting machine/stood	30
2	Drawing set Complete with pen for ink work	2
3	45o set square	2
4	60o set Square	2
5	Bleu printing Machine	1
6	Adjustable set Square	5
7	Desk Sharpener	5
8	Triangular Scale Rule (300mm)	5
9	Flat Scale Rule (300mm)	5
10	Blackboard Ruler	4-1
11	Blackboard Tee Square	4-1
12	Blackboard set Square (450 60o)	4 each 2
13	Blackboard compasses	4-1
14	Belabored projector	4-1
15	French Curve set	4-1
16	Letter Stencil (3mm, 6mm, 7mm and 10mm)	5 each
17	Rubber stencil (3mm, 6mm, 7mm, 6mm and 10mm)	5 each

18	Erasing stencil	5 each
19	Drawing rack/shelve for 30 students	
20	Personal computers	2
21	Plotter	1
22	Printer to handle A3 Size	1

FIELD FACILITY

COMPONENTS OF RAIL TRACK CONSISTING OF TWO PANELS

S/N	**DESCRIPTION OF ITEM S**	QUANTITY
1	Rail (12.2m)	4
2	Slippers (17 per panel)	34
3	Fish Plate	16
4	Fish bolt	32
5	Clips	
6	A-clips	68
7	B-clips	68
8	K-clips	68
9	Long bolt with nuts	68
10	Short bolt with nuts	68
11	Ballast stone (50mm diameter)	150 m^3

GUIDELINES FOR ASSESSMENT OF STUDENT PROJECTS

PART A: SUPERVOSOR'S ASSESSMENT

Title of Project:	
Name of Student:	
Registration Number:	
Course:	

S/N	Items	Maximum Score	Actual Score
1	Presentation of Report (if conformity with standards)	**6**	
2	Understanding of the problem(s) and the pursuit of it to achieve the set objectives	**7**	
3	Report content (Data collection, Test procedures, Design/Construction, results and discussions)	**12**	
4	Does the report read as an integrated whole? (e.g. Details of work should be put in appendices)	**12**	
5	Quality of English (Sentence construction, grammar, spelling)	**6**	
6	Conclusion, Recommendations and summary	**7**	
	Total	**50**	

Brief Remark

_____

_____

Name of Reader _____

Signature _____ Date _____

PART B: PANEL'S ASSESSMENT

Title of Project:	
Name of Student:	
Registration Number:	
Course:	

S/N	ITEMS	**Maximum Score**	**Actual Score**
1	Presentation of Report (if conformity with standards)	**10**	
2	Report content (Data collection, Test procedures, Design/Construction, results and discussions)	**20**	
3	Knowledge of theory	**10**	
4	Conclusion and summary	**10**	
5	Total	**50**	

Brief Remark

_____

_____

GUIDELINES FOR TEXTBOOK WRITERS

NATIONAL DIPLOMA

The following guidelines are suggestions from the Engineering Committees to the writers of the textbooks for the new curricula. They are intended to supplement the detailed syllabuses which have been produced, and which define the content and level of the courses.

Authors should bear in mind that the curriculum has been designed to give the students a broad understanding of applications in industry and commerce, and this is reflected in the curriculum objectives.

i. One book should be produced for each syllabus
ii. Page size should be A4
iii. The front size should be 12 point for normal text and 14 point where emphasis is needed
iv. Line spacing should be set to 1.5 lines
v. Headings and subheadings should be emboldened
vi. Photographs, diagrams and charts should be used extensively throughout the book, and these items must be up-to-date
vii. In all cases, the material must be related to industry and commerce, using real life examples wherever possible so that the book is not just a theory book. It must help the students to see the subject in the context of the 'real world'
viii. The philosophy of the courses is one of an integrated approach to theory and practice, and as such, the books should reflect this by not making an artificial divide between theory and practice.
ix. Illustrations should be labeled and numbered.
x. Examples should be drawn from Nigeria wherever possible, so that the information is set in a country context.
xi. Each chapter should end with student self-assessment questions (SAG) so that students can check their own master of the subject
xii. Accurate instructions should be given for any practical work having first conducted the practical to check that the instructions do indeed work
xiii. The books must have a proper index or table of contents, a list of references and an introduction based on the overall course philosophy and aims of the syllabus.
xiv. Symbols and units must be listed and a unified approach used throughout the book
xv. In case of queries regarding the contents of the books and the depth of information, the author must contact the relevant curriculum committee via the National Board for Technical Education
xvi. The final draft version of the books should be submitted to Nigerian members of the curriculum working groups for their comments regarding the content in relation to the desired syllabus.

PROJECT FORMAT AND MARKING SCHEME

Format

All Projects are to be written up and printed on A4 paper, double spaced and should normally not exceed 40 pages; appendices and tables outside the text may be incorporated as extra. The department or school shall give as much assistance as possible, for example, where funds permit in subsiding the binding cost.

Four bound copies should be submitted about a month to the ND II second semester examinations; one of these copies will be returned to the student.

Marking Scheme

There are three categories of assessing and marking student's project, these being:

- Supervisor'sMarks - **15%**
- Project Report Assessment by Supervisor/External Examiner - **60%**
- Oral Examination - **25%**

Supervisor's Marks

15% of the total marks will be allocated to the Supervisor exclusively who shall assess those aspects of practical work which are very difficult to quantify and are not necessarily apparent in the written, work. Such will include; the student's diligence, attitude and initiative in the face of non-controllable internal and external difficulties encountered.

Project Report

60% of the total marks will dwell on the overall quality and content of the project. The supervisor marks the project initially and this is without disclosure of original score passed on the External Examiner who using the same guidelines as below, awards his own marks. The two marks are moderated by the Board of Examiners which shall consist of all academic staff of the department or school. A general marking guide would include.

General Presentation

Considering: layout, quality of diagrams and photography, quality of English **- 20%**

Approach

Considers: Depth and Scope of Literature survey presentation of the aims of the project, design and construction work, operation of equipment, deficiencies in the techniques, precautions taken at experimental level and originality of thought or work **- 20%**

Treatment of Results

Considers: discussion, interpretation and critical assessment of results, linking up to previous and other work, conclusions and recommendation for further work **- 20%**

Oral Examination

The Board of Examiners of Moderating committee needs to familiarize themselves more fully with the work of the student as well as clarity of areas of misunderstanding that may arise from the report though an oral examination. This also aims at determining whether the report is a true and original account of work actually carried out.

The student shall be judged by his, confidence, presentation including mode of appearance, technical accuracy and other attributes that individual committees may deem necessary **- 25%**

LIST OF PARTICIPANTS AT THE PRE-CRITIQUE CURRICULUM WORKSHOP

S/N	NAME	ADDRESS	E-MAIL/PHONE NUMBER
1.	ENGR. DR. DANLADI M.D. NINGI	FEDERAL POLYTECHNIC, BAUCHI COREN REPRESENTATIVE	dmdningi@yahoo.com 08032878330
2.	ENGR. YUNUSA A.J.	KADUNA POLYTECHNIC, KADUNA	yunusaalisaid@yahoo.com 08038219664
3.	EMMANUEL ODHI	MANNY RAIL NIGRIAN LIMITED, LEKKI, LAGOS	08109852130
4.	ENGR. KOLO J.G.	DEPARTMENT OF CIVIL ENGINEERING YABA COLLEGE OF TECHNOLOGY, LAGOS	kolojohn62@gmail.com
5.	ABDUL TIJANI ABDULAKABA	DEPARTMENT OF MECHANICAL ENGINEERING KADUNA POLYTECHNIC, KADUNA	otarutijani@gmail.com 08038227796
6.	AUTA ABUBAKAR ADAMU ASSISTANT CHIEF TECHNICAL OFFICER	NIGERIAN RAILWAY COOPERATION, ZARIA	08035889420
7.	ENGR, ABDUSSALAM EL-SULEIMAN PhD HEAD OF DEPARTMENT, ELECTRICAL/ELECTRONIC.	DEPARTMENT OF MECHANICAL ENGINEERING FEDERAL POLYTECHNIC, NASARAWA	a.elsuleiman@gmail.com 08034589063
8.	DR. INNOCENT OKECHUKWU DEPT. OF MECHANICAL ENGINEERING	FEDERAL POLYTECHNIC, NASARAWA	innonnamd@gmail.com
9.	ENGR. JACOB SANNI DEPT. OF CIVIL ENGINEERING	FED DEPT. OF CIVIL ENGINEERING FEDERAL POLYTECHNIC, NASARAWA	sajacb@yahoo.com
10.	ENGR. UMAR USMAN	DEPT. OF ELECTRICAL ENGINEERING FEDERAL POLYTECHNIC, NASARAWA	namsu56@yahoo.com 08060266923
11.	IGHODARO ONAIWU DEPT. OF CIVIL ENGINEERING	FEDERAL POLYTECHNIC, NASARAWA	daromaxwell@gmail.com 08070674899
12.	DR. AGORO MUSLIU	DEPARTMENT OF CIVIL ENGINEERING	agoromusliu@yahoo.com 08033522071

		YABA COLLEGE OF TECHNOLOGY, LAGOS	
	NBTE STAFF		
1	DR. MAS'UDU ADAMU KAZAURE mni	EXECUTIVE SECRETARY NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	maskazaure@yahoo.com 08035867245
1	MAL. MUSA M. ISGOGO DIRECTOR POLYTECHNIC, PROGRAMES	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	duguiisgogo@gmail.com 08067185383
2	ABBA DANMOWA HEAD OF ENGINEERING DIVISION DEPUTY DIRECTOR ENGINEERING DIVISION	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	abbadanmowa@yahoo.com 08034304850
3	DR. FATIMA K. UMAR DEPUTY DIRECTOR CURRICULUM	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	fatikmama@yahoo.com 08034521639
4	MAL.SHAIBU Y. RINGIM DEPUTY DIRECTOR ENGINEERING	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	Alkujaja89@gmail.com 08034697876
5	DR. ENGR. O.O BELLO	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	engroobello@gmail.com 08083438400
6	ENGR. MOHAMMED SULEIMAN	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	Khalifas2006@gmail.com 08036423172
7	ENGR. HAMIDU ISA ABBA	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	hamiduaba@yahoo.com 08039645489
8	MRS. HASSANA ABDULLAHI SECRETARY	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	hassabdallah70@gmail.com 08037671945
9	MAL. MUSTAPHA AMINU SUPPORT STAFF	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	mustafarimi@yahoo.com 07032281995
10	MRS. RABI SANI SECRETARY	NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA	rabohio1@gmail.com 08036913246

LIST OF PARTICIPANTS AT THE NATIONAL CURRICULUM WORKSHOP

S/N	NAME	ADDRESS	E-MAIL AND PHONE NUMBER
1.	Dr.M.A.Kazaure mni	ES NBTE, Kaduna.	maskazaure@yahoo com 08035867245
2.	Dr. M. N. Ibrahim	Bayero University, Kano (COREN)	mnibrahim.cir@buk.edu.ng 080-36866293
3.	Mr. Emmanuel Odhi	Mannyrail Nigeria Limited, Lekki, Lagos	fosterodhi@yahoo.com 08109852130
4.	Engr. Sampson Ojon N	Federal Ministry of Transportation Ebutte-Metta, Lagos.	ojonsampson@yahoo.com 080-39541382
5.	Engr. Dr.MusliuOlalekanAgoro	Department of Civil Engineering Yaba College of Technology, Yaba, Lagos	agoromusliu@yahoo.com 080-33522071
6.	Engr. J.G. Kolo	Department of Mechanical Engineering Yaba College of Technology, Yaba, Lagos	kolojohn62@gmail.com 080-23047068
7.	Alh. Kamoru .A.Oyedokun (fpwi)	Railway Technical School Zaria	kamoruoyedokun@yahoo.com 080-34527863
8.	Engr. Dr.Yunusa A. Sai'd	Department of Electrical/Electronic Engineering, Kaduna Polytechnic, Kaduna	yunusaalisaid@yahoo.com 08038219664
9.	Engr. DanjumaAlhassan	Dept. of Civil Engineering, , Kaduna Polytechnic	thahyrr@gmail.com 08037002921
10.	Engr. Sani. M. Suleiman	Department of Mechanical Engineering, Kaduna Polytechnic, Kaduna	sanimalami1968@gmail.com 08023792886
11.	Engr. Dr. I.N. Okechukwu	Federal Polytechnic, Nasarawa	innonnamd@gmail.com 08131305208
12.	Dr.FunshoOlowoniyi	Federal Polytechnic Nasarawa	dayofun@yahoo.com 08033972612
13.	Haj.Fati J. Sabo	Federal Polytechnic Nasarawa	regfpn@yahoo.com
14.	Engr. Jacob EnewoSanni	Department of Civil Engineering Federal Polytechnic, Nasarawa	sajecs@yahoo.com 08035903412
15.	Engr. Usman Umar	Department of Electrical/Electronic Engineering Federal Polytechnic, Nasarawa	namsu56@yahoo.com 08060266923
16.	Engr. IghodaroOnaiwu	Department of Civil Engineering	daromaxwell@gmail.com

		Federal Polytechnic, Nasarawa	08070674699
NBTE STAFF			
17.	Mal. Musa M. Isgogo	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	dugujiisgogo@gmail.com 08067185383
18.	Engr. Abba M. Danmowa	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	abbadanmowa@yahoo.com 08034304850
19.	Dr. Fatima K. Umar	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	fatikmama@yahoo.com 08034521639
20.	Engr. Shaibu Y. Ringim	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	alkujaja89@gmail.com 08034697876
21.	Engr. Dr. O.O Bello	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	engroobello@gmail.com 08083438400
22.	Engr. M. Suleiman	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	khalifas2006@gmail.com 08036423172
23.	Engr. Hamidu Isa Abba	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	hamiduabba@yahoo.com 08039645489
SECRETARIAT			
24.	Mrs.Hassana Abdullah	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	hassabdallah70@gmail.com 08037671945
25.	Mrs. Rabi Sani	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	rabohio1@gmail.com 08036913246
26.	Ibrahim Yayork	Polytechnic Programmes Department, National Board for Technical Education, Kaduna	ibrahimyayork@gmail.com