

NATIONAL BOARD FOR TECHNICAL EDUCATION

NATIONAL INNOVATION DIPLOMA (NID)

IN

WELDING AND FABRICATION TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATIONS

2007

PLOT 'B' BIDA ROAD, P.M.B. 2239, KADUNA-NIGERIA

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NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING

1.0 Programme Nomenclature

National Innovation Diploma In Welding And Fabrication Engineering

2.0 Goal and Objectives

Goal: The programme is intended to produce Innovative Technicians in Welding and Fabrication for Innovation Enterprises, Self Employment, Private and Public Sectors of Nigerian Economy.

Objectives: A product of NID IN WELDING AND FABRICATION ENGINEERING should be able to:

- i. Carry out welding and fabrication operations.
- ii. Develop the ability to communicate their knowledge of techniques, processes and materials by developing their graphical skills including freehand sketching and measured drawing.
- iii. Develop practical bench based skills to manipulate a range of common metals directed to the realisation of ideas and the production of artefacts.
- iv. Provide experience in the use of some common machine tools.
- v. Establish a capacity to read and interpret formal working drawings and diagrammatic illustrations.
- vi. Acquire a body of knowledge to inform practical work and give a broad base of understanding of welding and metalworking.
- vii. Nurture a safe approach to practical work with materials using hand and machine tools.
- viii. Promote a capacity to solve specified technical design problems

- ix. Prepare appropriate engineering report.
- x. Apply management principles in organising supervisory groups and in the arrangement of sequence of activities.
- xi. Acquire and apply basic entrepreneur skills.
- xii. Apply adequate Information Technology (IT) skills.

3.0 **Entry requirements for National Innovation Diploma In Welding And Fabrication Engineering**

The general entry requirements for the NID programme are:

- i. Post Secondary School Leavers with 5 Credit level passes in SSCE or equivalent in Physics, Chemistry, Mathematics, English Language and any other science or technical subjects , who are desirous of acquiring relevant employable skills.
- ii. Unemployed or under-employed graduates looking for requisite employable skills.
- iii. Employed graduates who desire relevant or additional working skills.
- iv. Those out of school for a long time, in line with Government desire for open access to re-skilling and up-skilling of the nations workforce as part of Life Long Learning (LLL).
- v. Post NVC Final (articulation from the VEIs).

4.0 Curriculum:

4.1 The curriculum of the NID programme consists of four main components. These are:

- i) General Studies/Education
- ii) Foundation Courses
- iii) Core Courses
- iv) Supervised Industrial Work Experience (SIWE)

4.2 The General Education Component shall include courses in:

Art and Humanities- Use of English, Communication, Technical Report Writing and Presentation.

Social Studies- Entrepreneurship Development and Innovation and Acquisition of Technology.

4.3 The General Education component shall account for not more than 10% of total contact hours for the programme.

4.4 Foundation Courses include courses in Mathematics, Pure Science, Technical Drawing, etc. The number of hours will be about 10% of the total contact hours.

4.5 Core Courses are courses which give the student the theory and practical skills he needs to practice **Welding and Fabrication Engineering** at the technician level. These may account for between 80% of the contact hours.

4.6 Student Industrial Work Experience (SIWE) shall be taken during the long vacation following the end of the second semester of the first year. See details of SIWE at paragraph 9.0.

5.0 Curriculum Structure:

5.1 NID Programme

The structure of the NID programme consists of four semester of classroom, laboratory and workshop activities in the college and a semester (One year) of Student Industrial Work Experience (SIWE). Each semester shall be of 17weeks of duration made up as follows:

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 ACCREDITATION

The NID programme shall be accredited by the NBTE before the diplomates can be awarded of the diploma certificates. Details about the process of accrediting a programme for the award of the NID are available from the Executive Secretary, Programme Division, National Board for Technical Education, Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria.

7.0 Conditions for the Award of the NID:

Institutions offering accredited programmes will award will award the National Innovation 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 between 72 and 80 semester credit units.

8.0 Guidance Note for Teachers Teaching the Programme:

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

8.2 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 behavioural objectives, so that it is clear to all the expected performance of the student who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance are expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution. Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

8.4 The teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each 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 SIWE PROGRAMME.

9.1 For the smooth operation of the SIWE the following guidelines shall apply:

Responsibility for placement of students

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

b) The Placement Officer 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 students' work which has been agreed to by all polytechnics is adopted.

9.4 The Institution Based supervisor

The institution-based supervisor should initial the log book during each visit. This will enable him to check and determine to what extent the 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 visits; and

(2) a final visit in the last month of the attachment.

9.6 Stipends for Students in SIWE

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

CURRICULUM TABLE FOR NID IN WELDING AND FABRICATION ENGINEERING

FIRST SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
GNS 101	Use of English	2	-	-	2	2	
END 101	Entrepreneurship Development	2	-	-	2	2	
MTH 101	Algebra and Elementary Trigonometry	2	2	-	3	4	
WFC 101	Technical Drawing	2	-	3	3	5	
COM 101	Introduction to Computing	2	-	2	3	4	
MEC 101	Mechanical Engineering Science	2	-	2	3	4	
EEC 101	Introduction to Electrical Machines and Installation	2	-	3	3	5	
WFC 103	Basic Workshop Technology & Practice	1	-	6	3	7	
	Total	15	2	16	22	33	

SECOND SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
WFC 102	Innovation and Acquisition of Technology	2	-	-	2	2	
MTH 102	Calculus	2	2	-	2	4	
WFC 104	Engineering Materials	1	-	2	2	3	
WFC 106	Welding Metallurgy	1	-	2	2	3	
WFC 108	Weld and Metal corrosion	2	-	2	3	4	
WFC 110	Basic Elements of Welding and Fabrication Design	2	-	2	3	4	
WFC 112	Welding Technology and Practice	2	-	4	3	6	
WFC 114	Fabrication Technology and Practice	2	-	4	3	6	
	Total	16	2	12	22	30	

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THIRD SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
GNS 201	Communication Skills	2	-	-	2	2	
CAD 201	Computer Aided Design and Drafting(CADD)	-	-	3	3	3	
WFC 201	Engineering Measurement	2	-	-	2	2	
WFC 203	Underwater Welding & Cutting	2	-	3	3	5	
WFC 205	Plastic Welding Technology	2	-	3	3	5	
WFC 207	Machine Tool & Forging	2	-	3	3	5	
WFC 209	Foundry Technology & Practice	2	-	3	3	5	
WFC 211	Structural Steelwork	-	-	5	3	5	
	Total	12	-	18	22	32	

FOURTH SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
WFC 202	Technical Report Writing and Presentation	2	-	-	2	2	
WFC 204	Development and Assembly Drawing	-	-	3	3	3	
WFC 206	Testing and Quality Control of Welds	1	-	3	3	4	
WFC 208	Advanced Welding Processes	2	-	3	3	5	
WFC 210	Advanced Fabrication Processes	-	-	5	3	5	
WFC 212	Welding Economics & Management	2	-	-	2	2	
WFC 214	Health, Safety & Environment	2	-	-	2	2	
WFC 200	Final year project	-	-		4	-	
	Total	9	-	14	22	23	

FIRST SEMESTER

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	USE OF ENGLISH
CODE:	GNS 101
DURATION:	HOURS/WEEK: 2hrs
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Use of English.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand ways of promoting the necessary language skills which will enable student to cope effectively.
- 2.0 Understand the basic roles of grammar, the nature of the language and appreciate literary words in English.
- 3.0 Understand the basic rules of grammar.
- 4.0 Understand the essential qualities of paragraph.
- 5.0 Know literary works in English.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Use of English			COURSE CODE: GNS 101		CONTACT HOURS: 2-0-0	
Course Specification: Theoretical & Practical Content						
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Use of English						
WEEK	General Objective 1.0: Understand ways of promoting the necessary language skills which will enable student to cope effectively					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 4	1.1 Explain the necessity for acquiring good note-taking/making techniques. 1.2 List the methods of note-taking/making. 1.3 Explain the use of dictionary. 1.4 Explain the use of the library. 1.5 Explain the type of information sources in the library. 1.6 Identify good reading habits. 1.7 Explain the different methods of reading viz, scan, skim, normal and study. 1.8 Use the different methods of reading explained in 1.7 above	◆ Explain and ask the students: - the techniques of note-taking/making and list the various methods. - the correct ways of using the dictionary. - the best ways of using the library. - to list the various information sources in the library and how to locate these information sources. - the different methods of reading and the difference between the methods	◆ Recommended textbooks, Chalk, Blackboard, Duster, etc			
	General Objective 2.0: Understand the basic roles of grammar, the nature of the language and appreciate literary words in English					

5 – 8	<p>2.1 Explain the concept of language.</p> <p>2.2 List the characteristics of language.</p> <p>2.3 Explain the four language skills, viz: speaking, listening, writing, readings.</p> <p>2.4 Explain the functions of language.</p> <p>2.5 List the uses of English language in Nigeria, e.g as the language of research, government, commerce etc. 2.1.</p> <p>2. 6 Explain the concept of language.</p> <p>2.7 List the characteristics of language</p> <p>2.8 Explain the four language skills, viz: speaking, listening, writing, readings</p> <p>2.9 Explain the functions of language.</p> <p>2.10 List the uses of English language in Nigeria, e.g as the language of research, government, commerce etc.</p>	<p>◆ Explain and ask the students:</p> <ul style="list-style-type: none"> - the basic concept of language - to mention the characteristics of language - to identify the functions of language - to list the uses of English language in Nigeria 	<p>◆ Recommended textbooks, Chalk, Blackboard, Duster, etc</p>			
General Objective 3.0: Understand the basic rules of grammar						
9 - 11	<p>3.1 Explain grammar.</p> <p>3.2 Explain parts of speech.</p> <p>3.3 Analyse the use of</p>	<p>◆ Explain and ask the students:</p> <ul style="list-style-type: none"> - to explain grammar, parts of speech and 	<p>◆ Recommended textbooks, Chalk, Blackboard,</p>			

	<p>parts of speech in sentences.</p> <p>3.4 Correct common errors in the use of parts of speech in sentences.</p> <p>3.5 Explain how to construct sentences with correct syntactic arrangement.</p> <p>3.6 List punctuation marks.</p> <p>3.7 Enumerate the uses of punctuation marks and explain how to punctuate a given passage</p> <p>3.8 Explain idioms, figures of speech and affrication</p>	<p>how to apply them in a sentence</p> <ul style="list-style-type: none"> - to identify common errors in the use of parts of speech in sentences - to construct sentences with correct syntactic arrangement - to identify punctuation marks and their uses, and how to punctuate a given passage - to construct sentences to illustrate idioms, figure of speech and affixes 	Duster, etc			
General Objective 4.0: Understand the essential qualities of paragraph						
12 - 13	<p>4.1 Define a paragraph</p> <p>4.2 Name the parts of a paragraph viz: topic, sentence, development and conclusion/transition.</p> <p>4.3 Explain the thematic qualities of a paragraph viz, unity, coherence and emphasis.</p> <p>4.4 Explain methods of paragraph development viz, example, definition, comparison and contrast etc.</p>	<p>◆ Explain and ask the students:</p> <ul style="list-style-type: none"> - to define a paragraph and to name the part of a paragraph - what they understand by the thematic qualities of a paragraph - to explain the various methods of paragraph development and the methods of 	<p>◆ Recommended textbooks, Chalk, Blackboard, Duster, etc</p>			

	<p>4.5 Explain methods of ordering details in a paragraph, viz, less complex to more complex and vice versa, less important to more important and vice versa, spatial, chronological etc.</p> <p>4.6 Write specific paragraphs to illustrate 4.2 to 4.5 above.</p>	<p>ordering details in a paragraph</p> <ul style="list-style-type: none"> - Assess the students 				
General Objective 5.0: Know Literary works in English						
14 - 15	<p>5.1 Give the meaning of literature.</p> <p>5.2 Trace the development of literature.</p> <p>5.3 Differentiate between the literary genres</p> <p>5.4 Explain the functions of literature.</p> <p>5.5 Explain the terminology of prose fiction, e.g plot setting, characterization etc.</p> <p>5.6 Answer an essay question on a given novel.</p>	<ul style="list-style-type: none"> ◆ Explain and ask the students: <ul style="list-style-type: none"> - the meaning of literature and the development of literature - the functions of literature and the terminology of Prose fiction. - Assess the students. 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk, Blackboard, Duster, etc 			

Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	ENTREPRENUERSHIP DEVELOPMENT
CODE:	END 101
DURATION:	HOURS/WEEK: 2hrs
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate skills in Entrepreneurship

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the history of entrepreneurship development in Nigeria.
- 2.0 Understand the need, scope and characteristics of entrepreneurship.
- 3.0 Understand the various sources of information for entrepreneurship development.
- 4.0 Appreciate the roles of commercial and development banks in small scale industries development.
- 5.0 Understand the functions of various agencies in small and medium scale industries.
- 6.0 Understand the methods of Product selection.
- 7.0 Understand the activities of different Industrial Associations in relation to entrepreneurship.
- 8.0 Know self through analysis of strength, weakness, goal setting and risk taking behaviour.
- 9.0 Know the motivational pattern of entrepreneurs.
- 10.0 Understand the functional areas of business

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Entrepreneurship Development				COURSE CODE:END 101	CONTACT HOURS: 2-0-0	
Course Specification: Theoretical & Practical Content						
GOAL: This course is designed to enable students acquire adequate skills in Entrepreneurship						
WEEK	General Objective 1.0: Understand the history of entrepreneurship development in Nigeria.					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Explain the Entrepreneurship history in Nigeria. 1.2 Compare entrepreneurship in Nigeria with Japan, India, China, Malaysia, South Korea, etc. 1.3 Explain Nigeria's values and entrepreneurship. 1.4 Describe the role of entrepreneurship in the development of small and medium scale industries.	◆ Explain in details entrepreneurship , its historical development in Nigeria and role in small and medium scale industries. ◆ Compare entrepreneurship in Nigeria with other countries of the world – Japan, India, China etc..	◆ Text books ◆ Journals ◆ Publications ◆ Video Film ◆ TV ◆ VCR			
	General Objective 2.0: Understand the need, scope and characteristics of entrepreneurship					
2	2.1 Define entrepreneurship and entrepreneur. 2.2 Define the role and functions of entrepreneurship. 2.3 Identify the entrepreneurial	◆ Explain entrepreneurship and entrepreneur. ◆ Explain the	◆ Text books ◆ Journals ◆ Publications ◆ Entrepreneur			

	<p>traits.</p> <p>2.4 Explain entrepreneurial tasks.</p> <p>2.5 Explain the need for entrepreneurship in national economic development.</p> <p>2.6 Identify entrepreneurial risks and hazards</p>	<p>functions of entrepreneurship and its roles in national economic development.</p> <ul style="list-style-type: none"> ◆ Explain the various traits of an entrepreneur. ◆ Explain entrepreneurial tasks, the inherent risks and hazards. ◆ Invite a successful entrepreneur to give a talk to students 				
General Objective 3.0: Understand the various sources of information for entrepreneurship development						
3	<p>3.1 State organizations and agencies involved in the promotion and development of entrepreneurship.</p> <p>3.3 Explain the roles of banks and financial institutions in enterprise creation.</p> <p>3.4 Describe the contributions of government agencies in sourcing information including patent rights</p>	<ul style="list-style-type: none"> ◆ Explain the various organizations and agencies involved in the promotion and development of entrepreneurship . ◆ Explain the roles of banks and financial institutions in the creation of enterprises. ◆ Explain the 	<ul style="list-style-type: none"> ◆ Text books ◆ Journal of Management and Economic Digest Publications 			

		<p>contributions of government agencies in sourcing information and protecting enterprises.</p> <p>◆ Give assignment</p>				
General Objective 4.0: Appreciate the roles of commercial and development banks in small scale industries development						
4	<p>4.1 State financial institutions involved in entrepreneurship development.</p> <p>4.2 Describe the assistance provided by commercial banks.</p> <p>4.3 Explain the roles of development banks in the promotion and development of small and medium scale enterprises (SME's).</p> <p>4.4 Describe government policy on financing small and medium scale enterprises (SME's).</p>	<p>◆ Explain financial institutions involved in entrepreneurship development.</p> <p>◆ Explain the roles of commercial and development banks in the promotion and development of SME's.</p> <p>◆ Explain government policy on financing SME's</p>	<p>◆ Text books</p> <p>◆ Journals</p> <p>◆ Publications</p>			
General Objective 5.0: Understand the functions of various agencies in small and medium scale industries						
5	<p>5.1 State various support agencies involved in the promotion and development of entrepreneurship.</p> <p>5.2 Enumerate the functions of support agencies.</p> <p>5.3 Explain the assistance</p>	<p>◆ Explain the various support agencies involved in the promotion and development of entrepreneurship</p>	<p>◆ Text books</p> <p>◆ Journals</p> <p>◆ Publications</p> <p>◆ TV</p> <p>◆ VCR</p> <p>◆ Relevant Video</p>			

	<p>rendered by Research Institutions/Universities/Pol ytechnics/Monotechnics/Tec hnical Colleges in entrepreneurship development.</p> <p>5.4 Explain the roles of:</p> <ol style="list-style-type: none"> i. Nigerian Export Promotion Council (NEPC) ii. Nigerian Investment Promotion Commission (NIPC) iii. National Economic Reconstruction Fund (NERFUND) iv. National Directorate of Employment (NDE) v. Raw Materials Research and Development Council (RMRDC) 	<p>and their functions.</p> <ul style="list-style-type: none"> ◆ Explain the roles of research institutes, institutions of higher learning in the development of entrepreneurship ◆ Show a film on Technology Business Incubation Centre (TBIC) operation. ◆ Conduct Test. 	<ul style="list-style-type: none"> ◆ Cassettes 			
General Objective 6.0: Understand the methods of Product selection						
6 - 7	<p>6.1 Explain product selection.</p> <p>6.2 Explain product selection criteria.</p> <p>6.3 Identify key factors associated with product selection.</p> <p>6.4 Describe venture idea generation.</p> <p>6.5 Describe the steps involved in preliminary screening.</p> <p>6.6 Evaluate critically, product ideas.</p> <p>6.7 Explain the different steps in preparing pre-feasibility study.</p>	<ul style="list-style-type: none"> ◆ Explain 6.1 – 6.12 and assess the students. 	<ul style="list-style-type: none"> ◆ Text books ◆ Journals ◆ Publications 			

	<p>6.8 Evaluate adequacy of infrastructural facilities for product selection.</p> <p>6.9 Identify the relevant technology available for the selected product.</p> <p>6.10 Evaluate sources and adequacy of raw materials for a selected product.</p> <p>6.11 Explain effects of government policy and regulations on the selected product.</p> <p>6.12 Explain legal aspects of business in product selection.</p>					
General Objective 7.0: Understand the activities of different Industrial Associations in relation to entrepreneurship						
8 - 9	<p>7.1 Describe the roles of National Association of Small Scale Industrialists (NASSI) in entrepreneurship.</p> <p>7.2 Describe the roles of National Association of Small and Medium Entrepreneurs (NASME).</p> <p>7.3 Describe members of the Nigerian Association of Chambers of Commerce, Industry Mines and Agriculture (NACCIMA).</p> <p>7.4 Describe the roles of the Nigerian Association of Chambers of Commerce, Industry Mines and Agriculture (NACCIMA).</p>	<ul style="list-style-type: none"> ◆ Explain NASSI and its roles in entrepreneurship development. ◆ Explain NASME and its roles in entrepreneurship development. ◆ Explain City, States and bi-lateral chambers of commerce and industry and their roles in entrepreneurship development. ◆ Explain 	<ul style="list-style-type: none"> ◆ Text books ◆ Journals ◆ Publications 			

	<p>7.5 Explain the roles of Manufacturers Association of Nigeria (MAN) in the development of Small and Medium Scale Enterprises (SME's).</p> <p>7.6 Explain the activities of N.E.C.A and its roles in industry.</p>	<p>NACCIMA and its role in entrepreneurship</p> <ul style="list-style-type: none"> ◆ development. ◆ Explain MAN and its roles. ◆ Explain Nigerian Employers Consultative Association (N.E.C.A). and its roles. 				
General Objective 8.0: Know self through analysis of strength, weakness, goal setting and risk taking behaviour						
10-11	<p>8.1 Explain the following terms: Data collection about self. Who am I (personal efficacy) Rating of concepts Self Knowledge.</p> <p>8.2 Define individual life goal and link it to entrepreneurship.</p> <p>8.3 Identify the strengths and weaknesses in 8.2 above.</p> <p>8.4 Carry out a Ring TOSS Game.</p> <p>8.5 Explain the behavioural pattern observed in 8.4 above on:</p> <ol style="list-style-type: none"> i. Moderate risk taking. ii. Goal setting iii. Learning from feed back iv. Taking personal responsibility v. Confidence and self reliance 	<ul style="list-style-type: none"> ◆ Explain the term:- Data collection about self Personal efficacy Rating of concepts Self knowledge ◆ Explain individual life goal of entrepreneurship , their strengths and weaknesses. ◆ Explain Ring TOSS ◆ Guide students to carry out a Ring TOSS Game. ◆ Explain the 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc. 			

		<p>behavioural pattern observed in a Ring TOSS Game.</p> <ul style="list-style-type: none"> ◆ Moderate Risk Taking ◆ Goal Setting ◆ Learning from feedback ◆ Taking personal responsibility ◆ Confidence and self-reliance 				
General Objective 9: Know the motivational pattern of entrepreneurs						
12	<p>9.1 Define motivation</p> <p>9.2 List the objectives of motivation</p> <p>9.3 State and explain barriers to motivation and achievement.</p> <p>9.4 Analyse motive strength (from TAT scores) by:</p> <p>9.5 Locating achievement agencies Intensity of motives.</p>	<ul style="list-style-type: none"> ◆ Explain motivation, its objectives, merits and demerits. ◆ Carry out analysis on motive strength (from TAT scores) by locating achievement Imageries ◆ Intensity of motives. ◆ Give assignment 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc. 			
General Objective 10: Understand the functional areas of business						
	<p>10.1 Explain basic management concepts and functions.</p> <p>10.2 Describe human capital</p>	<ul style="list-style-type: none"> ◆ Explain in details the main functional areas of business and 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, 			

13 - 14	<p>function in small enterprise.</p> <p>10.3 Identify the sources of finance and financial needs.</p> <p>10.4 List the books of accounts necessary for operation of small enterprises.</p> <p>10.5 Identify the financial regulations and taxes affecting small enterprise operation.</p> <p>10.6 Explain the significance of insurance coverage for small enterprise.</p> <p>10.7 Describe the role of marketing in a small enterprise development.</p> <p>10.8 Explain the importance of marketing mix to the growth and expansion of a small enterprise.</p> <p>10.9 Explain the roles and functions of the following:-</p> <ul style="list-style-type: none"> i. Product Planning and Control ii. Production Forms and Techniques iii. Factory and facilities layout 	sources of finance and market.	Charts, etc.			
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	<p>iv. Work Process</p> <p>10.10 Explain the importance of quality control and production standards.</p> <p>10.11 Explain the need for maintenance management with special reference to:</p> <p>i. Routine maintenance</p> <p>ii. Scheduled Maintenance</p> <p>iii. Spare parts management and control</p> <p>iv. Preventive Maintenance</p>					
General Objective 11: Understand the need for business planning						
15	<p>11.1 Identify a viable business opportunity based on</p> <p>i. Demand</p> <p>ii. Availability of resources</p> <p>iii. Import substitution</p> <p>iv. Export oriented products</p> <p>11.2 Explain the different steps in preparing a preliminary project report.</p> <p>11.3 Formulate a bankable project report.</p> <p>11.4 Analyze a sample project report.</p>	<p>◆ Explain viable business and business opportunities based on:</p> <ul style="list-style-type: none"> - demand - availability of resources - import substitution - export oriented products <p>◆ Explain different steps in preparing a preliminary project and bankable project</p>	<p>◆ Text books</p> <p>◆ Journals</p> <p>◆ Publications</p>			

		report. ◆ Guide students to prepare a preliminary project report				
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Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	ALGEBRA AND ELEMENTARY TRIGNOMETRY
CODE:	MTH 101
DURATION:	HOURS/WEEK: 4hrs L – 2, T - 2
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and problem solving skills in Algebra and Trigonometry

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand laws of indices and their applications in simplifying algebra expressions.
- 2.0 Understand Theory of logarithms surds and their applications in manipulating expression.
- 3.0 Understand Principles underlying the construction of Charts and graphs.
- 4.0 Know the different methods of solving quadratic equations.
- 5.0 Understand Permutations and Combinations.
- 6.0 Understand the concept of set theory.
- 7.0 Understand the properties of arithmetic and geometric progressions.
- 8.0 Understand the binomial theorem and its application in the expansion of expressions and in approximations.
- 9.0 Understand the basic concepts and manipulation of vectors and their applications to the solutions of engineering problems.
- 10.0 Know the concept and solve quadratic equations with two unknown variables.
- 11.0 Understand the concept of trigonometric functions and apply them in solving problems.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Algebra and Elementary Trigonometry			COURSE CODE: MTH 101		CONTACT HOURS: 2-2-0	
Course Specification: Theoretical & Practical Content						
GOAL: This course is designed to enable students acquire adequate knowledge and problem solving skills in Algebra and Trigonometry						
WEEK	General Objective 1.0: Understand laws of indices and their applications in simplifying algebraic expressions					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Define index. 1.2 Establish the laws of indices. 1.3 Solve simple problems using the laws of indices.	Illustrate with examples the laws of indices and their application in simplifying algebraic expressions.	◆ Chalkboard, Textbooks, Calculators			
	General Objective 2.0: Understand Theory of logarithms surds and their applications in manipulating expression					
2 - 3	2.1 Define logarithm 2.2 Establish the four basic laws of logarithm 2.3 Solve simple logarithm problem 2.4 Define natural logarithm and common logarithm. 2.5 Define characteristic and mantissa	◆ Ask the students to solve logarithmic and surd related problems	◆ Chalkboard, ◆ Textbooks, ◆ Calculators			

	<p>2.6 Read the logarithmic table for given numbers</p> <p>2.7 Simplify numerical expressions using log tables e.g. e.g. $18 D = 3\%4JPC^2 \wedge M^B$. find D when J = 0935, e.g. $\theta = 35$, P = 1.6 10^6, C = 55, M = 0 0025. $\pi = 3.142$</p> <p>2.8 Apply logarithm in solving non-linear equations. e.g. $y = ax^n$; $\log y - \log a + n \log x$; $y = bc^x = \log y = \log b + x \log c$; $Y = a + bx^n$ B $\text{Log}(Y B D) = \text{Log} b + n \log x.$.</p> <p>2.9 Define surds</p> <p>2.10 Reduce a surd into its simplest form</p> <p>2.11 Solve simple problems on surds</p>					
General Objective 3.0: Understand Principles underlying the construction of Charts and graphs						
3	3.1 Construct graphs of functions fractions such as $Y = ax + b, n$	◆ Ask the students to draw graphs	◆ Chalkboard, Textbooks, Calculators			

	$= 1,2 Y = CST (a+x)$ $Y = ax^k$, including cases of asymbles 3.2Apply knowledge from 3.1 in determination as laws from experimental data.					
General Objective 4.0: Know the different methods of solving quadratic equations						
4	4.1 Solve quadratic equations by factorization 4.2 Solve quadratic equations by method of completing squares. 4.3 Solve quadratic equations by formula 4.4 Determine the roots. 4.5 Form equations whose roots are given in different methods.	♦ Ask the students to solve quadratic equations	♦ Chalkboard, Textbooks, Calculators			
General Objective 5.0: Understand Permutations and Combinations						
5	5.1 Define permutation 5.2 State examples of permutations 5.3 Define combination 5.4 State examples of combination 5.5 Establish the	♦ Give exercises on permutation and combination to them	♦ Chalkboard, Textbooks, Calculators			

	theorem $nPr = \frac{n!}{(n-r)!}$ giving examples e.g. number of ways of collecting two out of 8 balls.					
General Objective 6.0: Understand the concept of set theory						
6 – 7	<p>6.1 Establish ${}^nC_r = \frac{{}^nC_n}{r}$.</p> <p>6.2 Define sets, subsets, and null sets.</p> <p>6.3 Define union, inter-section and completion of sets.</p> <p>6.4 Draw Venn diagrams to demonstrate the concepts in 6.1 B 6.3 above.</p> <p>6.5 Calculate the size or number of elements in a given set.</p>	<p>◆ Give exercises on set theory to the students.</p>	<p>◆ Chalkboard, Textbooks, Calculators</p>			
General Objective 7.0: Understand the properties of arithmetic and geometric progressions						
	<p>7.1 Define an Arithmetic progression (A.P.)</p> <p>7.2 Obtain the formula for nth term and the first n terms of an A.P.</p>	<p>◆ Ask the students to apply progression to solve problems</p>	<p>◆ Chalkboard, Textbooks, Calculators</p>			

8 - 9	<p>7.3 Give examples of the above e.g. find the 20th term of the series e.g. $2 + 4 + 6 + Y..$ Find also the series of the first 20 terms.</p> <p>7.4 Define a geometric progression (G.P.)</p> <p>7.5 Obtain the formula for the nth term and the first n terms of a geometric series.</p> <p>7.6 State examples of 7.5 above e.g. given the sequences $1/3, 1, 3 Y$ find the 20th term and hence the sum of the 1st 20 terms.</p> <p>7.7 Define Arithmetic Mean (AM) and Geometric Mean (G.M.)</p> <p>7.8 Define convergency of series.</p> <p>7.9 Define divergence of series.</p>					
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General Objective 8.0: Understand the binomial theorem and its application in the expansion of expressions and in approximations.						
10 - 11	8.1	Explain the method of mathematical induction	♦ State the importance and application of the theorem.	Recommend textbooks, Chalk/Chalkboard, Duster, Charts, etc.		
	8.2	State and prove the binomial theorem for a positive integral index.				
	8.3	Expand expressions of the forms $(x + y)^2$, $(x^2 + y)^s$ applying binomial theorem				
	8.4	Find the coefficient of a particular term in the expansion of simple binomial expressions.				
	8.5	Find the middle term in the expansion of binomial expression				
	8.6	State the binomial theorem for a rational index.				
	8.7	Expand expressions of the form: $(1 + x)^{-1}$, $(1 + x)^2$				

	8.8	, $(1 B x)^{-a}$ applying binomial theorem Expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$, $(1 + x)^2$, $(1 B x)^a$ to a stated degree of accuracy applying scalar expressions.					
General Objectives 9.0: Understand the basic concepts and manipulation of vectors and their applications to the solutions of engineering problems							
12 - 11	9.1 9.2 9.3 9.4 9.5 9.6	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 Identify quantities that may be classified as vector e.g. displacement velocity, acceleration, force etc.	◆ Apply the techniques of vectors to solve various problems.	Recommend textbooks, Chalk/Chalkboard, Duster, Charts, etc.			

	<p>9.7 Compute the modulus of any given vector up to 2 and 3 dimensions.</p> <p>9.8 State the parallelogram law in solving problems including addition and subtraction of vectors</p> <p>9.9 Apply the parallelogram law in solving problems including addition and subtraction of vectors.</p> <p>9.10 Explain the concept of components of a vector and the meaning of orthogonal components.</p> <p>9.11 Resolve a vector into its orthogonal components.</p> <p>9.12 List characteristics of coplanar localized vectors.</p> <p>9.13 Define the resultant or composition of coplanar vectors.</p>					
	<p>9.14 Compute the resultant of coplanar forces acting at a point</p>					

	<p>9.15 using algebraic and graphical methods. Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces.</p> <p>9.16 Apply vectoral techniques in solving problems involving relative velocity.</p> <p>9.17 State the scalar product of two vectors.</p> <p>9.18 Compute the scalar product of given vectors.</p> <p>9.19 Define the cross product of the vector product or two vectors.</p> <p>9.20 Calculate the direction ratios of given vectors.</p> <p>9.21 Calculate the angle between two vectors using the scalar product.</p>					
General Objective 10.0 Know the concept and solve quadratic equation with two unknown variables						
	<p>10.1 Explain the concept of equation, ie. $A = B$ where A and B are expressions.</p>	<p>◆ Ask the student to solve various equations as indicated in</p>	<p>◆ Chalkboard, ◆ Textbooks, ◆ Calculators</p>			

13	<p>10.2 List different types of equations:- Linear, quadratic, cubic, etc.</p> <p>10.3 State examples of linear simultaneous equations with two unknowns and simultaneous equations with at least one quadratic equation.</p> <p>10.4 Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation.</p> <p>10.5 Apply the algebraic and graphical methods in solving two simultaneous quadratic equations.</p> <p>10.6 Define a determinant of n^{th} order.</p> <p>10.7 Apply determinants of order 2 and 3 in solving simultaneous linear equations.</p>	section 10.				
General Objective 11.0 Understand the concept of trigonometric functions and apply them in solving problems.						
	11.1 Define the basic	◆ Define and	◆ Chalkboard,			

14 - 15	<p>trigonometric ratios, sine, cosine and tangent of an angle.</p> <p>11.2 Derive the other trigonometric ratios; cosecant, secant and cotangent using the basic trigonometric ratios in 11.1 above.</p> <p>11.3 Derive identities involving the trigonometric ratios of the form; $\cos^2 \theta + \sin^2 \theta = 1$, $\sec^2 \theta = 1 + \tan^2 \theta$, etc.</p> <p>11.4 Derive the compound angle formulae for $\sin(A+B)$, $\cos(A+B)$ and $\tan(A+B)$.</p>	Derive the trigonometric ratios and identities	<ul style="list-style-type: none"> ◆ Textbooks, ◆ Calculators. 			
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Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	TECHNICAL DRAWING
CODE:	WFC 101
DURATION:	HOURS/WEEK : 5hrs L – 2, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Technical Drawing

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know different drawing instruments, equipment and materials used in technical drawing.
- 2.0 Know graphical communication.
- 3.0 Know the construction of simple geometrical figures and shapes.
- 4.0 Know Isometric and Oblique Projections.
- 5.0 Know single orthographic projections.
- 6.0 Understand the interactions of regular solids.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Technical Drawing			COURSE CODE: WFC 101		CONTACT HOURS: 2-0-3	
Course Specification: Theoretical & Practical Content						
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Technical Drawing						
WEEK	General Objective 1.0: Know different drawing instruments, equipment and materials used in technical drawing.					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 3	<p>1.1 State the different types of drawing instruments, equipment and materials.</p> <p>1.2 Outline the uses of the various instruments, equipment and materials.</p> <p>1.3 State the precautions necessary to preserve items 1.1 above.</p>	<p>◆ Explain in details the features of drawing instruments and precautions to be observed while using them.</p>	<p>◆ Black board ruler (1m)</p> <p>◆ Black board Tee-Square</p> <p>◆ Black board compass</p> <p>◆ Blackboard protector</p> <p>◆ Adjustable set-square</p> <p>60 set square</p> <p>45 set square</p> <p>French curve set</p> <p>Templates</p> <p>◆ Duster</p> <p>◆ Chalk</p> <p>Complete drawing table</p>	<p>1.1 Identify the different types of drawing instruments, equipment and materials.</p> <p>1.4 Use each of the items in 1.1 above.</p> <p>1.5 Maintain the various instruments and equipment.</p>	<p>◆ Guide the students to identify, use and maintain all the drawing instruments, equipment and materials:</p> <p>a. Drawing set</p> <p>b.T-Square</p> <p>c. Drawing board</p> <p>d. Set squares</p> <p>e. Types of pencils (H to B), etc.</p>	<p>◆ Black board ruler (1m)</p> <p>◆ Black board Tee-Square</p> <p>◆ Black board compass</p> <p>◆ Blackboard protector</p> <p>◆ Adjustable set-square</p> <p>60 set square</p> <p>45 set square</p> <p>French curve set</p> <p>Templates</p> <p>◆ Duster</p> <p>◆ Chalk</p> <p>◆ Complete</p>

						drawing table
General Objective 2.0: Know Graphical Communication.						
4 - 5	<p>2.1 Explain graphics and the different types of graphic presentation.</p> <p>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.</p> <p>2.3 Layout of drawing sheets with the following (a) Margins (b) Title block etc.</p> <p>2.4 State the various standards of drawing sheets.</p> <p>2.5 Print letters and figures of various forms and characters.</p> <p>2.6 Illustrate conventional</p>	<p>◆ Demonstrate activities 2.1 to 2.6 for the students to learn and allow them to practise.</p> <p>◆ Assess the students' graded assignments.</p>				

	signs, symbols and appropriate lettering characters.					
General Objective 3.0: Know the construction of simple geometrical figures and shapes.						
6 - 7	<p>3.1 Explain the purpose of geometrical construction in drawing parallel.</p> <p>3.2 Define a circle.</p> <p>3.3 Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.</p> <p>3.4 Define a circle.</p> <p>3.5 Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.</p> <p>3.6 Define an ellipse.</p> <p>3.7 Explain the following draughting techniques (a) Projection method (b) Measurement method (c) Transposition method.</p>	<ul style="list-style-type: none"> ◆ Explain in detail details the process of construction simple geometrical figures and shapes. ◆ Guide the students to construct regular polygon such as pentagon, hexagon, heptagon, etc using different methods. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ 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 ◆ Duster ◆ Chalk ◆ Complete drawing table 	<p>3.1 Construct parallel and perpendicular lines.</p> <p>3.2 Construct and bisect lines, angles and areas.</p> <p>3.3 Divide a straight line into given number of equal parts.</p> <p>3.4 Identify polygons (regular or irregular)</p> <p>3.5 Construct regular polygons with N sides in a given circle, given (a) distance across flats (b) distance across corners.</p> <p>3.6 Carry out simple geometrical constructions on circles e.g.</p> <p>(a) diameter of a circle of a circle of a given circumference.</p> <p>(b) the circumference to a circle of a given diameter</p> <p>(c) a circle to pass through 3 points</p>	<p>Demonstrate activities 3.1 to 3.8 for the students to learn and assess them.</p>	<ul style="list-style-type: none"> ◆ 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 ◆ Duster ◆ Chalk ◆ Complete drawing table

				<p>(d) a circle to pass through 2 points and touch a given line</p> <p>(e) a circle to touch a given smaller circle and a given line</p> <p>(f) tangents to points</p> <p>(g) an arc of radius tangent to two lines at an angle to less than and more than 90.</p> <p>(h) an are externally tangent to two circles</p> <p>(i) inscribing and circumscribing circles circles at various.</p> <p>3.7 Construct plane scales and diagonal scales, using appropriate instruments.</p> <p>3.8 Construct ellipse by using:</p> <p>(a) trammal method</p> <p>(b) concentric circle method.</p>		
General Objective 4.0: Know Isometric and Oblique Projections						
	4.1 Explain isometric and oblique projections	◆ Ask students to differentiate between Isometric and oblique projections and	◆ Recommended textbooks. Chalkboard, dust, chalk, lecture notes,	4.1 Draw a square in isometric and oblique forms. 4.2 Draw a circle in Isometric and	◆ Ask students to construct a square and circle in isometric and	◆ Recommended textbooks. Chalkboard, dust, chalk, lecture notes,

8 – 9		assess	drawing sets	<p>oblique forms.</p> <p>4.3 Draw an ellipse in Isometric and oblique forms.</p> <p>4.4 Draw a polygon with a minimum of eight sides in Isometric and oblique forms</p> <p>4.5 Dimension holes, circles, arcs and angles correctly on isometric and obliques.</p> <p>4.6 Use appropriate convention symbols and abbreviations.</p>	<p>oblique projections and assess</p> <p>◆ Ask students to draw a polygon in isometric and oblique projections and assess</p> <p>◆ Ask students to construct and dimension holes circles, arcs and angles in isometric and oblique projection and label with appropriate conventional symbols and abbreviations and assess</p>	drawing sets
General Objective 5.0: Know single orthographic projections						
11 - 12	<p>5.1 Explain the principle of orthographic projection.</p> <p>5.2 Illustrate the principle planes of projection</p> <p>(a) Vertical plane</p> <p>(b) Horizontal plane.</p> <p>5.3 Explain why the first and third angles are used and</p>	<p>◆ Ask students to differentiate between first and third angle orthographic projection and assess.</p> <p>◆ Ask students to explain the vertical and horizontal planes in orthographic</p>	<p>◆ Recommended textbooks. Chalkboard, dust, chalk, lecture notes, drawing sets</p>	<p>5.1 Project views of three-dimensional objects on to the basic planes of projection in both first and third angle to obtain</p> <p>(a) the front view or elevation</p> <p>(b) the top view or plan.</p>	<p>◆ Ask students to construct orthographic projections of simple objects in first and third angle orthographic projections and assess.</p>	<p>◆ Black board ruler (1m)</p> <p>◆ Black board Tee-Square</p> <p>◆ Black board compass</p> <p>◆ Blackboard protector</p> <p>◆ Adjustable set-square</p> <p>60 set square</p> <p>45 set square</p>

	the second and fourth angles not used.	projection and assess.					French curve set Templates ◆ Duster ◆ Chalk ◆ Complete drawing table
General Objective 6.0: Understand the intersections of regular solids							
13 - 15	6.1 Explain interpretation or intersections of solids	◆ Ask students to give examples of intersection of solids	◆ Recommended textbooks. Chalkboard, dust, chalk, lecture notes, drawing sets	6.1 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 angle	◆ Ask students to construct: a. Two square-prisms meeting at right angles b. Two dissimilar square prisms meeting at “ c. Two dissimilar square prisms meeting 60 d. An hexagonal prism meeting a square prism	◆ 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 ◆ Duster ◆ Chalk ◆ Complete drawing table	

Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	INTRODUCTION TO COMPUTING
CODE:	COM 101
DURATION:	HOURS/WEEK : 4hrs L – 2, P - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Computing

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the basic components of the computer and how it has evolved over the years
- 2.0 Know how data is stored and applications of various operating systems
- 3.0 Understand the operation of Windows operating system and application
- 4.0 Understand file Management and software package

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Introduction to Computing			COURSE CODE: COM 101		CONTACT HOURS: 2-0-2	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Computing						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand the basic components of the computer and how it has evolved over the years					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 3	1.1 Give a brief history of computer development. 1.2 State the uses of computer and understand the impact of the PC on computer technology. 1.3 Differentiate between hardware and software 1.4 Explain the input-process-output algorithm with the following in mind: 1. Central processor 2. Input Mechanism 3. Output Mechanism	<ul style="list-style-type: none"> ◆ 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 	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, ec.			
	General Objective 2.0: Know how data is stored and applications of various operating systems					

<p>4 – 7</p>	<p>2.1 Explain the application of the following:</p> <p>a. RAM b. ROM c. Fixed discs d. Removable</p> <p>2.2 Describe the concept of an operating system</p> <p>i. PC-DOS/MS DOS ii. Windows iii. Linux iv. Unix</p>	<ul style="list-style-type: none"> ◆ 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 	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts, ec.</p>			
<p>General Objective 3.0: Understand the operation of Windows operating system and application</p>						
<p>8 - 10</p>	<p>3.1 Give an overview of Windows Operating system.</p> <p>3.2 State the steps for opening and closing windows.</p> <p>3.3 Explain the application of program Manager</p> <p>3.4 State the uses and application of the various windows bars.</p> <p>3.5 Explain the concept of the following</p>	<ul style="list-style-type: none"> ◆ Discuss the advantage of Windows Operating System ◆ Explain the Windows Menu and tools. ◆ Illustrate in details with diagrams where necessary. ◆ Assess the student 	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts, ec.</p>	<p>3.1 Move from one window to another and concurrently</p> <p>3.2 Create files and folders</p> <p>3.3 Manage files and folders(moving copying, saving deleting, printing, etc)</p>	<p>Demonstrate activities 3.1 to 3.3 for the students to learn and assess them.</p>	<ul style="list-style-type: none"> ◆ 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

	software package i. MS Office ii. Lotus Smart suite iii. MS Encarta					Board, Multimedia projector system
General Objective 4.0: Understand file Management and software package						
11 - 13				<p>4.1 Use a word processing packages such as MS Word or Word Perfect and covering the following:</p> <ul style="list-style-type: none"> - Entering text - Formatting text (boldening,, font size, italizing, etc) - Creating and saving text files - Importing objects - Spelling and grammar checking - Creating and manipulating tables, text boxes equations - Printing and file export 	<ul style="list-style-type: none"> ◆ Demonstrate the installation of MS Word. ◆ Identify the different features of the software ◆ 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 ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ 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.

Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	MECHANICAL ENGINEERING SCIENCE
CODE:	MEC 101
DURATION:	HOURS/WEEK : 4hrs L – 2, P - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Mechanical Engineering Science

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know the Basic Principles of Statics
- 2.0 Understand the concept and effect of forces and their moment
- 3.0 Understand the effect of friction and the law governing it
- 4.0 Know the forces in simple frames and structures

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Mechanical Engineering Science			COURSE CODE: MEC 101		CONTACT HOURS: 2-0-2	
Course Specification: Theoretical & Practical Content						
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Mechanical Engineering Science						
WEEK	General Objective 1.0: Know the Basic Principles of Statics					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Define a Scalar quantity. 1.2 Define vector quantity. 1.3 Distinguish between 1.1 and 1.2. 1.4 Give examples in 1.1 and 1.2. 1.5 Explain the concept of particles and rigid body	◆ Explain in details the basic principles of statics and the concepts of particles and rigid bodies.	◆ Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc	1.1 Locate the centre of gravity of plane areas. 1.2 Determine graphically the centre of gravity of plane areas and solid bodies	◆ Demonstrate activities 1.1 and 1.2 for the students to learn and ask them to carry out all the activities.	
	General Objective 2.0: Understand the concept and effect of forces and its moments					
3 - 5	2.1 Define force. 2.2 Describe the conditions for the equilibrium of coplanar forces. 2.3 State the principles of parallelogram of force. 2.4 Explain how to	◆ Explain in details the concept and effects of forces and their moments. ◆ Guide the students to solve problems relating to forces and its moments. ◆ Assess students'	◆ Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	2.1 Construct parallelogram of force. 2.2 Draw triangle of forces. 2.3 Draw polygon of forces. 2.4 Verify Lami's theorem using a	◆ Demonstrate activities 1.1 to 1.5 for the students to learn and ask them to carry out all the activities	◆ Drawing materials/instruments

	<p>construct parallelogram of force.</p> <p>2.5 Calculate the resultant of a system of two forces.</p> <p>2.6 State the principle of triangle of force.</p> <p>2.7 Resolve forces into components.</p> <p>2.8 Resolve a force into force and couple.</p> <p>2.9 Define moment of a force.</p> <p>2.10 State the principles of moments.</p> <p>2.11 Solve problems related to 2.1 to 2.11 above.</p>	<p>graded assignment</p>		<p>force board.</p> <p>2.5 Verify the parallelogram law of forces.</p>		
General Objective 3.0: Understand the effect of friction and the law governing it						
6 – 8	<p>3.1 Define friction.</p> <p>3.2 State advantages and disadvantages of friction.</p> <p>3.3 Define coefficient of friction.</p> <p>3.4 Define limiting angle of friction.</p> <p>3.5 Define angle of Repose.</p> <p>3.6 Solve problems related to 3.1 to 3.5.</p>	<p>◆ Explain in details the principles and effects of friction and the law governing it.</p> <p>◆ Guide the students to solve problems relating to friction.</p>		<p>3.1 Determine the coefficient of friction by means of an inclined plane.</p>	<p>◆ Demonstrate activity 3.1 for the students to learn and ask them to carry out the activity</p>	<p>◆ Specimens of masses, inclined plain set-up. Protractor, etc.</p>
General Objective 4.0: Know the forces in simple frames and structures						
	<p>4.1 Explain forces in the members (including Trusses) using free</p>	<p>◆ Explain in details the features and concepts of forces</p>		<p>4.1 Apply BOW's notation for graphical analysis of</p>	<p>◆ Demonstrate the experiments in 4.1 and 4.2 for</p>	<p>◆ Specimens of forces acting on members of</p>

9 - 11	Body Diagram. 4.2 State the general conditions for equilibrium	in simple frames and structures		simple frame structures. 4.2 Determine the nature of the forces acting on each member of simple frame.	the students to learn and ask them to carry out the experiments	simple frames.
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Assessment : Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	INTRODUCTION TO ELECTRICAL MACHINES AND INSTALLATION
CODE:	EEC 101
DURATION:	HOURS/WEEK : 7hrs L – 1, P - 6
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Electrical Machines and Installation

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the construction and principle of operation of d.c, Machines.
- 2.0 Understand basic principles of a transformer and application.
- 3.0 Understand Construction, principle of operation and application of a.c machines.
- 4.0 Understand the basic knowledge and skill in electrical installation
- 5.0 Know how to produce schematic and wiring drawing.
- 6.0 Understand how to produce sectional and architectural drawings
- 7.0 Know the importance of Cables in Electrical Installations
- 8.0 Understand the estimating procedures for electrical installations
- 9.0 Understand installation of various electrical/electronic systems.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Introduction to Electrical Machines and Installation			COURSE CODE: EEC 101		CONTACT HOURS: 1-0-6	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Electrical Machines and Installation						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand the construction and principle of operation of d.c, Machines.					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Describe, with the aid of a labelled diagram, the construction of a dc motor. 1.2 State materials used in the construction of various parts dc machines. 1.3 State the functions of armature windings and field windings. 1.4 Show the student a typical lap & wave winding of a dc machine. 1.5 Differentiate between lap and wave windings. 1.6 Draw diagrams of lap and wave windings. 1.7 Derive emf equation of dc machine. 1.8 Solve problems involving 1.4 and 1.6. 1.9 State factors that affect the emf equations. 1.10 Derive the equation $V=E+I_a R_a$ (for a	<ul style="list-style-type: none"> ◆ The teacher should give the detail construction of d.c machines. ◆ Ask the students to solve problems on d.c machines. ◆ Explain the conditions for parallel operation of d.c machines. ◆ Discuss different types of starters and their applications. 	<ul style="list-style-type: none"> ◆ Chalk, board, textbooks, d.c machines, writing materials, calculators. 			

	<p>motor) Or $E = V + IR$ (for a generator).</p> <p>1.11 Explain, with the aid of developed diagram, armature reaction and methods of minimising it.</p> <p>1.12 Stop circuit representations of dc machines and calculate current and voltage drop.</p> <p>1.13 Explain concept of back emf.</p> <p>1.14 Explain the need for Starters for a dc motor.</p> <p>1.15 Describe different Starters for dc motors.</p> <p>1.16 Derive the condition for maximum efficiency of dc machine.</p> <p>1.17 State conditions for parallel operation of dc machines.</p> <p>1.18 Solve problems involving 1.1 to 1.17</p>					
General Objective 2.0: Understand basic principles of a transformer and application.						
	<p>2.1 Describe with labelled diagrams the construction and principles of operation of single-phase transformer.</p>	<p>◆ The teacher should ensure that the construction and operation of transformer is illustrated with</p>	<p>◆ Chalk, Chalkboard, ◆ Textbooks, ◆ Charts, etc.</p>	<p>2.1 Perform experiment on open circuit characteristics of a single-phase transformer. 2.2 Perform experiment</p>	<p>◆ Teacher should assist the students when carrying out experiment</p>	<p>◆ Transformers (single and three phase), a.c machines, starters,</p>

<p>3 - 4</p>	<p>2.2 List different types of cores used in transformer construction.</p> <p>2.3 Explain with the aid of phasor diagrams the action of a transformer on load and on no-load.</p> <p>2.4 Derive transformation equations of a transformer.</p> <p>2.5 Draw an equivalent circuit for a transformer.</p> <p>2.6 Describe with the aid of an equivalent circuit, a practical transformer.</p> <p>2.7 Determine the equivalent circuit of a transformer with parameters referred to the primary or secondary.</p> <p>2.8 List standard terminal markings for a single, 2-phase, and 3-phase transformers as governed by BS171.</p> <p>2.9 Define efficiency of transformers.</p> <p>2.10 Calculate efficiency of a transformer.</p> <p>2.11 Derive the expression for maximum</p>	<p>diagrams.</p> <p>◆ Ask the students to solve problems associated with single phase and three phase transformers</p>		<p>on open circuit characteristics of three-phase transformer.</p> <p>2.3 Carryout experiment on close circuit characteristics of a single-phase transformer.</p> <p>2.4 Perform experiment on close circuit characteristics of three-phase transformer.</p> <p>2.5 Perform experiment on identifying polarity of a 3-phase transformer</p>		<p>voltmeter, ammeter, tachometer, phase sequence meter, practical manual practical logbook</p>
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	efficiency of a transformer (Single and 3-phase).					
General Objective 3.0: Understand Construction, principle of operation and application of a.c machines.						
5 - 6	<p>3.1 Discuss how rotating field are produced and how polyphase machines are constructed (use diagrams.</p> <p>3.2 Differentiate between synchronous and induction machines.</p> <p>3.3 Describe the component parts of a 3-phase Induction motor (Squirrel cage and wound type)</p> <p>3.4 Explain the principles of operation of Induction machine.</p> <p>3.5 Define synchronous speed and slip.</p> <p>3.6 Solve problems relating to 3.4 and 3.5.</p> <p>3.7 List the component parts of an Alternator.</p> <p>3.8 Derive the e.m.f equations of an Alternator.</p> <p>3.9 Explain the principle of operation of a single phase induction motor.</p> <p>3.10 Calculate efficiency of</p>	<ul style="list-style-type: none"> ◆ The teacher should discuss the principles of operation of induction and synchronous machine. ◆ Give simple problems involving a.c machines. ◆ Discuss the essential features of induction motor. ◆ Explain the operational principle of alternator. ◆ Give assignments to students and assess them. 	<ul style="list-style-type: none"> ◆ Chalk, board, textbooks and a.c machines , writing materials , lecture note, calculator 	<p>3.1 Perform experiments on open and close circuit characteristics of a single induction motor.</p> <p>3.2 Carryout experiments on open and close circuit characteristics of a three-phase induction motion.</p> <p>3.3 Carryout experiment on open circuit characteristics of an alternator/a.c</p>	<ul style="list-style-type: none"> ◆ Teacher should assist the students when carrying out experiment 	<ul style="list-style-type: none"> ◆ Transformers (single and three phase), a.c machines, starters, voltmeter, ammeter, tachometer, phase sequence meter, practical manual practical logbook

	<p>an Induction motor.</p> <p>3.11 Derive an expression for maximum efficiency of an Induction motor.</p> <p>3.12 Explain various applications of an Induction machine.</p> <p>3.13 Solve simple problems involving ac machines.</p> <p>3.14 Explain the various types of enclosures and cooling arrangements of electrical machines (dc motors and ac motors).</p>					
General Objective 4.0: Understand the basic knowledge and skill in electrical installation						
7				<p>4.1 Identify electrical/electronic graphical symbols:</p> <p>a. Resistor</p> <p>b. Capacitor</p> <p>c. Inductor</p> <p>d. Diodes</p> <p>e. Thyristor</p> <p>f. Diac</p> <p>g. Triac</p> <p>h. Operational Amplifier</p> <p>i. Logic gates</p> <p>j. Linear IC</p> <p>k. Power Switches</p> <p>l. Sockets</p> <p>m. Isolator Switch</p> <p>n. Breakers</p>	<p>◆ The teacher should show and draw electrical/electronic graphical symbols to the students</p>	<p>◆ Charts showing graphical symbols must be available in the laboratory</p>

				<p>o. Motors p. Fans q. ELCB. 4.2 Draw symbols in 1.1 above using appropriate instruments.</p>		
General Objective 5.0: Know how to produce schematic and wiring drawing.						
8 - 9	<p>5.1 Explain schematic and wiring diagram. 5.2 State the merits and demerits of schematic diagrams. 5.3 Explain wiring diagram. 5.4 5.4 State the merits and demerits of wiring diagrams. 5.6 Explain methods of preventing hazards. 5.7 Define earth continuity conductor, earth electrode, consumer's earth terminal. 5.8 Explain the necessity for earthing and state the relevant regulations concerning earthing. 5.9 Explain the protection of an installation by fuse and by ELCB. 5.10 Distinguish between solid earthing practice and earth leakage circuit breaker protection.</p>	<p>◆ The teacher should draft various schematic diagram for electrical/ electronic circuits and panel to the students. ◆ Teacher to draft various wiring diagrams to students</p>	<p>◆ Drawing Instrument and drawing boards. Typical samples of architectural drawings</p>	<p>5.1 Draw electrical/electronic graphical symbols.</p>	<p>◆ The teacher should give assignments to students and assess them.</p>	<p>◆ Graphical symbol, charts, drawing sets and materials</p>

	<p>5.11 State a number of problems associated with earth leakage circuit breakers.</p> <p>5.12 Describe how the human body can become part of an electric circuit.</p> <p>5.13 Explain how to prevent electric shock</p> <p>5.14 Explain methods of treating electric shock.</p> <p>5.15 Explain artificial respiration</p> <p>a. mouth resuscitation</p> <p>b. revised Holger Nelson resuscitation</p> <p>c. external cardio compression/cardio-pulmonary resuscitation.</p>					
General Objective 6.0: Understand how to produce sectional and architectural drawings						
10	<p>6.1 Explain architectural drawings and symbols</p> <p>6.2 Interpret architectural drawings</p>	<p>◆ Teacher to draft architectural drawings of simple building e.g. 3-bedroom flat.</p>	<p>◆ Chalk, board, textbooks,</p> <p>◆ Charts, Etc.</p>	<p>6.1 Draft various electrical/electronic schematic diagrams.</p> <p>6.2 Draft various electrical installation/wiring diagrams.</p> <p>6.3 Draft architectural drawings of simple buildings e.g. 3-bedroom flat etc.</p> <p>6.4 Produce elevation drawings for</p>	<p>◆ The teacher should give assignments to students and assess them.</p>	<p>◆ Graphical symbol, charts, drawing sets and materials</p>

				<p>architectural drawings.</p> <p>6.5 Draft electrical services for a residential building e.g. 3-bedroom flat.</p> <p>6.6 Draft electrical supply for a 3-bedroom building.</p> <p>6.7 Draw the installation diagram for a single phase and three-phase energy meters in domestic and commercial/industrial premises.</p>		
General Objective 7.0: Know the importance of Cables in Electrical Installations						
11 - 12	<p>7.1 Define the following diversity factor ambient temperature, class of excess current protection, and disposition of cable.</p> <p>7.2 Explain the use of relevant IEE tables for cable selection.</p> <p>7.3 Apply 4.1 and 4.2 for close selection.</p> <p>7.4 Design an external supply system for a 3-bedroom building.</p> <p>7.5 Draft electrical services for a simple 3-bedroom building.</p>	<p>◆ The teacher should show to the student various cable sizes used in wiring and services building.</p> <p>◆ Draw typical electrical supply systems for building.</p>		<p>7.1 Demonstrate various types of joints using PVC and flexible cables</p>	<p>◆ The teacher should give assignments to students and assess them.</p>	<p>◆ Graphical symbol, charts, drawing sets and materials</p>

	<p>7.6 Calculate the total load current for a final sub circuit in the building.</p> <p>7.7 List the main types of insulating and conducting materials.</p> <p>7.8 Distinguish between conductors and insulators.</p> <p>7.9 Describe, with the aid of sketches, the construction of different types of cables.</p> <p>7.10 State the advantages and disadvantages when using:</p> <ol style="list-style-type: none"> a. PVE - Insulated, PVC - sheathed cables. b. Mineral - Insulated metal - sheathed cables c. Armoured PVC - insulated, PVC - sheathed cables d. Steel and PVC conducts e. Steel and PVC trunking. f. Flexible cabled and cord etc. <p>7.11 Explain the general I.E.E. Regulation related to cables and</p>					
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	<p>their uses.</p> <p>7.12 Identify the cable colour coding, commonly used in Nigeria.</p>					
General Objective 8.0: Understand the estimating procedures for electrical installations						
13	<p>8.1 Produce item quantities from drawings.</p> <p>8.2 Estimate cost of materials</p>	<p>◆ Prepare typical bills of quantities for electrical installations.</p>		<p>8.1 Prepare Bills of Engineering Measurements and Materials for an electrical installation</p>	<p>◆ The teacher should give assignments to students and assess them.</p>	
General Objective 9.0 Understand installation of various electrical/electronic systems.						
14 – 15	<p>9.1 Explain the Installation of Public address system.</p> <p>9.2 Explain the Installation of television system.</p> <p>9.3 Explain the computer system.</p> <p>9.4 Explain the Electrical services of residential and commercial /industrial premises.</p> <p>9.5 Explain the single phase and three-phase energy meters in domestic and commercial/industrial premises.</p>	<p>◆ The teacher should illustrate the installation of the system with appropriate diagram and procedure.</p>	<p>◆ Samples of installation diagrams</p>	<p>9.1 Carry out installation of a typical electrical/electronic</p>	<p>◆ The teacher should give assignments to students and assess them.</p>	

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	BASIC WORKSHOP TECHNOLOGY AND PRACTICE
CODE:	WFC 103
DURATION:	HOURS/WEEK : 7hrs L – 1, P - 6
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Basic Workshop Practice

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know safety precautions.
- 2.0 Know how to use and maintain various bench tools.
- 3.0 Know how to use simple measuring and testing equipment.
- 4.0 Know drilling operations.
- 5.0 Know various tapping operations.
- 6.0 Know reaming operation.
- 7.0 Know various metal joining operations
- 8.0 Know how to cut and join metal by gas welding.
- 9.0 Know various metal arc welding operation
- 10.0 Understand various techniques for controlling distortion in welding operations.
- 11.0 Know the use of various wood working tools.
- 12.0 Know simple operations on plastics.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Basic Workshop Technology & Practice			COURSE CODE: WFC 103		CONTACT HOURS: 1-0-6	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Basic Workshop Practice						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know safety precautions					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 State safety precautions during workshop practice. 1.2 List protective wears used during workshop practice. 1.3 List all safety rules and regulation.	◆ Explain in details safety rules and regulations in workshop practice.	◆ Chalkboard, Textbooks, Charts, etc	1.1 Observe safety precautions. 1.2 Operate safety equipment e.g. fire extinguishers, safety water hose etc. 1.3 Use of protective wears. 1.4 Observe all safety rules and regulations	◆ Demonstrate activities 1.1 to 1.4 for the students to learn and ask them to carry out all the activities	◆ CO ₂ fire extinguisher Water hose Sand buckets,
	General Objective 2.0 Know how to use and maintain various bench tools.					
2				2.1 Use marking-out tools on the bench correctly. 2.2 Produce simple objects using bench/hand tools such as files, chisels, scrapers, saws etc. 2.3 Maintain files, dividers, saws, gauges try squares, bevel etc.	◆ Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to carry out all the activities	◆ Micrometer Screw ◆ Gauge, Vernier Calliper, Steel rule,
	General Objective 3.0 Know how to use simple measuring and testing requirements					
				3.1 Perform simple measuring exercises using steel rules, vernier callipers and micrometers. 3.2 Use dial indicators to	◆ Demonstrate activities 3.1 to 3.5 for the students to learn and ask them to	◆ spirit level surface roughness tester (portable

3				i. set up jobs on the lathe ii. roundness testing etc. 3.3 Carry out exercises involving flatness squareness, 3.4 Perform taper measurement on jobs using vernier protractor and sine bars. 3.5 Inspect jobs using simple comparators straightness and surface finish test	carry out all the activities	type) SURF TEST 4 90° angle gauge straight edge vernier protractor sine bar set of standard slip gauges marking out table bench comparator 0-100 mm S-d Test mandrels
General Objective 4.0: Know drilling operations						
4	4.1 Discuss the nomenclature of a twist drill. 4.2 Discuss the formulae for calculation of speed of various sizes of drills: $n = [v \times 1000] / [1 \times d]$ Where n = no. of rev/min d = dia of drill in mm v = cutting speed	◆ Explain in details the features and processes of drilling operations. ◆ Guide the students to calculate the speed of various sizes of drills.	◆ Chalkboard, Textbooks, Charts, etc	4.1 Carryout drilling operation on a centre lathe machine. 4.2 Drill different sizes of holes on drilling machine.	◆ Demonstrate activities 4.1 to 4.2 for the students to learn and ask them to carry out all the activities	◆ Drill bits ◆ Centre lathe machine and accessories. ◆ Pillar drilling machine and accessories.
General Objective 5.0: Know various tapping operations						
	5.1 State the correct tapping drill size. 5.2 Explain how to correct taps.	◆ Explain in details the principles of tapping.	◆ Recommended textbook, Lecture notes, Chalkboard,	5.1 Select correct tapping drill size. 5.2 Select correct taps. 5.3 Carry out tapping operation	◆ Demonstrate activities 5.1 to 5.2 for the students to learn	

5		◆ Guide the students to calculate the tapping drill size for v-threads.	Chalk ,Duster, etc	(i) on the work bench (ii) on drilling machine (iii) on lathe	and ask them to carry out all the activities ◆ Assess the students.	
General Objective 6.0: Know reaming operations						
6 - 7				6.1 Carry out reaming operations: i. on the bench ii. on drilling/lathe 6.2 Select correct speeds for reaming small and large holes.	◆ Demonstrate activities 6.1 to 6.2 for the students to learn and ask them to carry out all the activities	◆ Hand reamers ◆ Machine reamers ◆ Tap wrench ◆ Jacobs chuck and key ◆ Medium size Lathe ◆ Reduction sleeves ◆ Radial drilling machine ◆ Pillar drilling machine
General Objective 7.0: Know various metal joining operations.						
8-9	7.1 Explain the processes of fabrication of metal container by knock-up joining. 7.2 Explain out soft soldering			7.1 Fabricate metal container by Knock-up joining. 7.2 Join metals by the grooving technique. 7.3 Carry out soft soldering.	◆ Demonstrate activities 7.1 to 7.3 for the students to learn and ask them to carry out all the activities	◆ OXY-acetylene gas welding set Manual rolling machine Guillotine shear Assorted cutting snips Bending machine

General Objective 8: Know how to cut and join metals by gas welding						
10				8.1 Assemble OXY-acetylene welding plant. 8.2 Select various welding regulators, clips, blow pipe and nozzles. 8.3 Perform gas welding by various welding techniques Cut by flame cutting technique	◆ Demonstrate activities 8.1 to 8.3 for the students to learn and ask them to carry out all the activities	◆ Gas welding equipment and its accessories.
General Objective 9.0: Know various metal arc welding operations						
11				9.1 Regulate current and determine polarity for metal arc welding. 9.2 Determine polarity and select current. 9.3 Perform various arc-welding joints by down hand and vertical operation. 9.4 Select and prepare metal edges of various thicknesses for various welding techniques.	◆ Demonstrate activities 9.1 to 9.4 for the students to learn and ask them to carry out all the activities	◆ Electric arc welding Machine and its accessories
General Objective 10.0: Understand various techniques for controlling distortion in welding operations						
12				10.1 Apply correctly the stop back and skip method of controlling distortion. 10.2 Apply pre and post heating technique	◆ Demonstrate activities 10.1 to 10.2 for the students to learn and ask them to carry out all the activities	
General Objective 11.0: Know the use of various wood working tools.						
	11.1 State the applications of the following:	◆ Explain in details the features and operations of	◆ Recommended textbook, Lecture notes,	11.1 Carry out the applications using the following:	◆ Demonstrate activities 11.1 to 11.4 for the	◆ Try square Dividers, Gauges

<p>13</p>	<p>a) Geometric/marketing out tools e.g. try square, dividers and gauges b) Planning tools e.g. Jack, smooth, try planes, spoke shaves, etc. c) Cutting tools e.g. saws chisels, knives, boring tools. d) Impelling tools e.g. hammer and mallets. e) Pneumatic tools.</p> <p>11.2 Describe portable electric hand tools in wood work, e.g. portable saw, portable planer, portable drill, portable sander and jig saw.</p> <p>11.3 Explain the operations of the tools in 11.1.</p> <p>11.4 List basic wood working machine's such as:</p> <p>a. Surface planning and thickening machine. b. Circular sawing</p>	<p>various wood working tools.</p>	<p>Chalkboard, Chalk ,Duster, etc</p>	<p>a. Geometric/marketing out tools e.g. try square, dividers and gauges. b. Planing tools e.g. jack, smooth, try planes, spoke shaves etc. c. Cutting tools, e.g. saws, chisels, knives, boring tools. d. Impelling tools e.g. hammers and mallets. e. Pneumatic tools.</p> <p>11.2 Mark out and prepare wood to a given specification using the tools in 11.1</p> <p>11.3 Maintain all tools in 11.1</p> <p>11.4 Carry out various wood work operations using the tools in 11.1</p>	<p>students to learn and ask them to carry out all the activities</p>	<p>Jack plane, Smooth plane Try plane, Panel saws Chisels, Knives Boring tools Hammers, Mallets Oil stone, Bench/table grinder, Oil can Portable saw Portable planner Portable drill</p>
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	<p>machine.</p> <p>c. Morticing machine</p> <p>d. Drilling machine.</p> <p>e. Single ended tenon machine.</p> <p>f. Band sawing machines and safety precaution in their operations</p>					
General Objective 12.0: Know simple operations on plastics						
14				<p>12.1 Identify various types of plastic groups such as thermo-setting and thermo-plastic.</p> <p>12.2 Use conventional metal cutting tools to perform operations on each type in 14.1</p> <p>12.3 Carry out joining operations using plastics in 13.1.</p> <p>12.4 Review previous activities and assess students.</p> <p>12.5 Assess the students graded practical works and reports.</p>	<p>◆ Demonstrate activities 12.1 to 12.4 for the students to learn and ask them to carry out all the activities</p>	<p>◆ Set of drill Wood turning lathe HSS cutting tools Evostic glue</p>

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

SECOND SEMESTER

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	INNOVATION AND ACQUISITION OF TECHNOLOGY
CODE:	WFC 102
DURATION:	HOURS/WEEK : 2hrs
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Innovation and Acquisition of Technology.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the early development of technology
- 2.0 Comprehend the history of modern technology
- 3.0 Appreciate Technological Advancements.
- 4.0 Understand Technological Development in Nigeria
- 5.0 Know the responsibilities of Engineering personnel.
- 6.0 Know the regulation and Control of Engineering Practice in Nigeria
- 7.0 Comprehend the concept “Transfer of Technology“

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Innovation and Acquisition of Technology			Course Code: WFC 102		Contact Hours: 2-0-0 Hrs/Wk	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Innovation and Acquisition of Technology.						
Course Specification: Theoretical Contents						
WEEK	General Objective 1.0: Understand the early development of technology					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Define the term Service. 1.2 Define the term engineering. 1.3 Define the term technology, integrating the views of Drucker, Genron, Schon, etc. 1.4 Trace the history of engineering from early Egyptian, Greek and Roman civilizations. 1.5 Evaluate the contribution and problems of early technology.	◆ Ask the students to illustrate a concept in science, engineering and technology	Recommended Textbook, Chalk/Chalkboard, Duster, Charts, etc			
	General Objective 2.0 Comprehend the history of modern technology					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
2-3	2.1 Critically examine the concept of modern technology. 2.2 Trace the historical development of modern civilization. 2.3 Evaluate the events in the 16 th and 17 th centuries which made scientific enquiry a tool for	◆ Ask the students to give examples of early technology, in Nigeria and elsewhere Ask the students to enumerate technological innovations of the 16 ^h and 17 th	◆ Chalkboard, Duster, Recommended Textbooks ◆ Lecture Notes, etc.			

	<p>technology development.</p> <p>2.4 Define and explain the term industrial Revolution</p> <p>2.5 Analyze the impact of the industrial Revolution in Europe.</p> <p>2.6 Outline the lessons of the Industrial Revolution in Nigeria.</p>	centuries				
General Objective 3.0: Appreciate Technological Advancements						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
4-5	<p>3.1 State the pervasive nature of technological advances</p> <p>3.2 illustrate the role of materials in technology.</p> <p>3.3 illustrate the importance of technology in the manufacturing Industry</p> <p>3.4 Evaluate Lady Woodwards “Technology Theory”.</p> <p>3.5 State the role of technology in the development of power and fuels.</p> <p>3.6 Explain improvement in transportation through technology.</p> <p>3.7 Evaluate technology advances in welding & fabrication</p>	<ul style="list-style-type: none"> ◆ Ask the students to trace the history of revolution from Britain to Nigeria. ◆ Ask the students to list the historical development of transportation from steam engines to jet engines. ◆ Ask the students to list the advances in welding from gas welding to robotic welding. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Chalk and Blackboard, ◆ Duster ◆ Recommended Textbook ◆ Lecture Notes, etc. 			
General Objective 4.0: Understand Technological Development in Nigeria						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
6-8	4.1 Explain early indigenous	◆ Ask the students to	◆ Chalk and			

	<p>technology in Nigeria.</p> <p>4.2 Explain the influence of foreign technology on Nigeria Indigenous technology.</p> <p>4.3 State the main features of Nigeria National policy on Technology.</p> <p>4.4 Evaluate the present state of Technology in Nigeria</p>	<p>name outstanding technological development in Nigeria That are wholly indigenous</p>	<p>Blackboard, ◆ Duster ◆ Recommended Textbook ◆ Lecture Notes, etc.</p>			
General Objective 5.0: Know the responsibilities of Engineering personnel.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
	<p>5.1 Outline the social, moral and professional responsibilities of the engineer in the society.</p> <p>5.2 Analyses proposals, target time and strategies as these terms affects national development plans in Nigeria.</p> <p>5.3 List the roles of the engineer in national development and national defense.</p> <p>5.4 List the working and professional relationship of the engineer to the technologist, the technician and the craftsman in the execution of engineering contracts in Nigeria.</p> <p>5.5 State the ratios of engineers to technologist, engineers</p>	<p>Illustrate in details the responsibilities of Engineering personnel.</p> <p>Assess the students.</p>	<p>Recommended Textbook, Chalk/Chalkboard, Duster, Charts, etc</p>			

	to technician, Engineers to craftsmen which are considered ideal for execution of engineering jobs					
General Objective 6.0 Know the regulation and Control of Engineering Practice in Nigeria						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
9 - 11	<p>6.1 List all the professional bodies in Engineering in Nigeria.e.g. Council for the Regulation of Engineering in Nigeria(COREN) Nigerian Society of Engineers (NSE), including all its Divisions and Institutes (e.g. Mechanical, Chemical, Structural etc), Nigerian Institute of Welding (NIW), National Association of Technologist in Engineering (NATE), Nigerian Society of Engineering Technicians (NASET) and National association of Engineering Craftsmen (NAEC)</p> <p>6.2 Explain the aims and objectives of each body listed in 8.1 above.</p> <p>6.3 State the requirement for</p>	<ul style="list-style-type: none"> ◆ Ask the students to name the activities of professional bodies. especially in engineering. ◆ Ask the students to define the jobs of craftsman, technician, technologist and engineers ◆ Assess the students. 	Recommended Textbook, Chalk/Chalkboard, Duster, Charts, etc			

	<p>registration by the regulatory body, COREN.</p> <p>6.4 State the requirements for corporate, honorary graduate and student membership of each society or association listed in 6.1 above.</p>					
General Objective 7.0 Comprehend the concept “Transfer of Technology“						
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
12 - 14	<p>7.1 Explain the Technology transfer concept from the perspectives of the less advanced countries and those of the advanced countries.</p> <p>7.2 Evaluate the advantages and disadvantages of transfer of technology.</p> <p>7.3 State the problems and prospects of technology transfer to Nigeria.</p> <p>7.4 Suggest possible alternatives to technology transfer to Nigeria.</p> <p>7.5 Formulate a feasible plan for providing Nigeria with indigenous comprehensive know-how in machine plant/equipment design and manufacture by the year 2020</p>	<ul style="list-style-type: none"> ◆ Illustrate in details and ask the students to explain how they believe technology can be transferred ◆ Assess the students. 	<p>Recommended Textbook, Chalk/Chalkboard, Duster, Charts, etc</p>			

Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	CALCULUS
CODE:	MTH 102
DURATION:	HOURS/WEEK : 4hrs L – 2, T - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and problem solving skills in Calculus

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the basic concepts of differential Calculus and its application in solving engineering problems
- 2.0 Know integration as the reverse of differentiation and its application to engineering problems
- 3.0 Understand first order homogenous linear ordinary differential equations with constant coefficients as applied to simple engineering problems
- 4.0 Understand the basic concepts of partial differentiation and apply same to engineering problems

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: CALCULUS			Course Code: MTH 102		Contact Hours 2-2-0	
GOAL: This course is designed to enable students acquire adequate knowledge and problem solving skills in Calculus						
Course Specification: Theoretical Content				Practical Content		
General Objective: 1.0 Understand the basic concepts of differential Calculus and its application in solving engineering problems						
Week	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1 – 4	1.1 Define limits with examples. 1.2 State and prove basic theorems on limits 1.3 Prove that $\lim \sin \theta/\theta$, $\lim \tan \theta/\theta = 1$ as $\theta \rightarrow 0$ 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	◆ Teachers are explain to give and solve simple engineering and technological problems	◆ Chalkboard, textbooks, lecture notes, chalk, etc			

	<p>technological problems.</p> <p>1.10 Explain the rate of change of a function.</p> <p>1.11 Explain the condition for turning point of a function.</p> <p>1.12 Distinguish between maximum and minimum value of a function.</p> <p>1.13 Sketch the graph of a function showing its maximum and minimum points and points of reflexion.</p> <p>1.14 Estimate error quantities from the small increment of a function.</p> <p>1.15 Determine the tangent to a curve.</p> <p>1.16 Determine the normal to a curve.</p>					
General Objective 2.0: Know integration as the reverse of differentiation and its application to engineering problems						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
5-8	<p>2.1 Define integration as the reverse of differentiation.</p> <p>2.2 Explain integration as a limit of summation of a function.</p> <p>2.3 Distinguish between indefinite and definite integrals.</p> <p>2.4 Determine the indefinite and definite integrals.</p> <p>2.5 Determine the definite integral of a function.</p>	<p>◆ Ask students to apply integral calculus to simple function.</p> <p>◆ Explain in details with solved examples, the principle of integration.</p>	<p>◆ Chalkboard, textbooks, lecture notes, chalk</p>			

	<p>2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple functions.</p> <p>2.7 List possible methods of integration.</p> <p>2.8 Integrate algebraic and trigonometric functions by the substitution method.</p> <p>2.9 Integrate trigonometric and exponential functions by parts.</p> <p>2.10 Integrate algebraic functions by partial fraction.</p> <p>2.11 Integrate trigonometric and logarithmic functions applying reduction formula.</p> <p>2.12 State standard forms of some basic integrals.</p> <p>2.13 Calculate length of arc, area under a curve, area between two curves, volume of revolution, center of gravity, center of surface area, second moment and moment of inertia.</p> <p>2.14 Define Trapezoidal and Simpson's rule as methods of approximating areas under given curves.</p> <p>2.15 Find approximate area under a curve applying</p>					
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	<p>Trapezoidal method.</p> <p>2.16 Find approximate area under a curve applying Simpson's rule.</p> <p>2.17 Compare result obtained from Trapezoidal and Simpson's rules with the results by direct integration.</p> <p>2.18 Apply integration to kinematics.</p>					
General Objective 3.0: Understand first order homogenous linear ordinary differential equations with constant coefficients as applied to simple engineering problems.						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
9-12	<p>3.1 Define first order differential equation</p> <p>3.2 List order, degree, general solution, boundary or initial conditions and particular solution of differential equations.</p> <p>3.3 List examples of various types of first order differential equations.</p> <p>3.4 Define first order homogenous differential equations</p> <p>3.5 List the methods of solving differential equations by separable variables.</p> <p>3.6 Identify differential equations reducible to the homogenous form.</p>	<p>◆ Ask students to apply differential equation to solve engineering problems.</p> <p>◆ Explain in details with solved examples the application of differential equations to engineering problems.</p>	<p>◆ Chalkboard, textbooks, lecture notes, chalk, etc.</p>			

	<p>3.7 Explain exact differential equations.</p> <p>3.8 Solve exact differential equations, e.g. (a) Show that $(3x^2 + y \cos x) dx + (\sin x - 4y^3) dy = 0$ is an exact differential equation. (b) Find its general solution.</p> <p>3.9 Define integrating factors.</p> <p>3.10 Determine the solution of differential equations using integrating factors.</p> <p>3.11 Define linear differential equations of the first order.</p>					
General Objective 4.0: Understand the basic concepts of partial differentiation and apply same to engineering problems.						
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
13-15	<p>4.1 Define partial differentiation</p> <p>4.2 List and explain the uses of partial derivatives.</p> <p>4.3 Solve problems on partial differentiation. e.g. $f(x, y) = x^2 + y^2 = 2xy$ find $dy/dx, dx/dy$</p> <p>4.4 Apply partial differentiation to engineering problems.</p>	<p>◆ Solve problems on partial differential</p> <p>◆ Equations.</p>	<p>◆ Chalkboard, textbooks, lecture notes, chalk</p>			

Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	ENGINEERING MATERIALS
CODE:	WFC 104
DURATION:	HOURS/WEEK : 3hrs L – 1, P - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Engineering Material.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand engineering materials and their properties
- 2.0 Know the structure and energy of atoms.
- 3.0 Understand atomic bonding and coordination.
- 4.0 Understand crystalline geometry
- 5.0 Understand crystalline phases
- 6.0 Know structural disorders in materials
- 7.0 Understand molecular phases

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Engineering Materials			COURSE CODE: WFC 102		CONTACT HOURS: 1-0-2	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Engineering Material.						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand engineering materials and their properties					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 3	1.1 State types of engineering materials 1.2 Define principal mechanical properties: stress, strain, elastic modulus, yield strength, ductility, elongation, reduction of area, hardness and toughness. 1.3 State the role of each property in 1.2 above in engineering application of materials. 1.4 Define thermal expansion, heat capacity and thermal conductivity of material. 1.5 State the relevance of 1.4 above in	◆ Explain engineering materials and their properties. ◆ Explain the determination of properties. ◆ State the mathematical expressions, relating the properties to determinable quantities. ◆ State problems associated with the properties above. ◆ Give exercises ◆ Assess the students.	◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts. ◆ Sample of Engineering Materials (Plastics, Wood, Metal, Concrete, etc.).			

	<p>engineering applications.</p> <p>1.6 Describe the determination of variables in 1.2 and 1.4 above.</p> <p>1.7 Define electrical conductivity, resistivity and polarisation of engineering materials.</p> <p>1.8 State the relationship between electrical conductivity and temperature, strain, composition and thermal conductivity.</p> <p>1.9 Describe the determination of electrical conductivity and resistivity for engineering materials.</p> <p>Solve mathematical problems associated with properties in 1.2, 1.4 and 1.7.</p>					
General Objective 2.0: Know the structure and energy of atoms.						
4 - 5	<p>2.1 Describe electronic structure of atoms.</p> <p>2.2 Give an expression of the relationship between energy possessed by a</p>	<p>◆ Illustrate the electronic configuration of atoms and rotation of sub-shells in K,L,M,N,and O</p>	<p>◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts</p> <p>◆ Structural</p>			

	<p>photon and its wavelength.</p> <p>2.3 Explain electron notation using S,P,D sub-shell of K,L,M,N,O shells of an atom.</p> <p>2.4 Explain energy distributions and electron excitations in atoms.</p> <p>Solve mathematical problems associated with 2.2 and 2.4 above</p>	<p>shells.</p> <ul style="list-style-type: none"> ◆ Use the related law to explain energy distribution and electron excitation in atoms. ◆ Solve mathematical problems based on energy expressions. ◆ Give exercises. 	<p>Model of Atoms.</p>			
General Objective 3.0: Understand atomic bonding and coordination.						
6 - 7	<p>3.1 State the four general types of inter-atomic bonds in materials.</p> <p>3.2 Explain the occurrence of inter-atomic bonds in materials.</p> <p>3.3 Explain the expression showing the relationship between energy change of two approaching ions and their inter-ionic distance and electronic charges.</p> <p>3.4 Define coordination number and ionic radius.</p> <p>3.5 Relate coordination number with radii</p>	<ul style="list-style-type: none"> ◆ Explain the different types of bonds and how they result. ◆ Give expressions indicating relationship between ions, distance and electronic charges. ◆ Relate coordination number to radii ratios and their effect on bonding. 	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>			

	<p>ratios.</p> <p>3.6 State how 3.5 affect ionic and/or covalent bonding.</p> <p>3.7 Explain the terms: poly-atomic ions and free-radicals.</p> <p>State the effect of 3.7 in engineering materials properties.</p>					
General Objective 4.0: Understand crystalline geometry						
8 - 9	<p>4.1 Define a phase, crystalline solids, short and long range orders.</p> <p>4.2 Give examples of each 4.1 above.</p> <p>4.3 Describe the close-packed crystals (hcp, fcc) and body centred cubic (bcc) crystals with examples.</p> <p>4.4 Describe the structure of ionic and molecular crystals.</p> <p>Give examples of 4.4 above.</p>	<ul style="list-style-type: none"> ◆ Explain crystalline structures in solids. ◆ Mention phase, short and long range orders. ◆ Explain ionic and molecular structures and polymorphism. ◆ Give examples of metals with those structures i.e.: b.c.c., f.c.c. & h.c.p. 				
General Objective 5.0: Understand crystalline phases.						
	<p>5.1 Explain the Bravais lattices.</p> <p>5.2 Give example of crystal structures belonging to a given Bravais lattice.</p> <p>5.3 Describe types of</p>	<ul style="list-style-type: none"> ◆ Discuss Bravais lattices. ◆ Give examples of crystallographic structures for particular lattices. ◆ State types of 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts. ◆ Models of B.C.C., F.C.C. 			

<p>10 -11</p>	<p>symmetry possible within a lattice.</p> <p>5.4 Determine the Bravais lattice of NaCl, CsCl.</p> <p>5.5 Explain the lattice directions with reference to:</p> <ul style="list-style-type: none"> i vector relationship, ii lattice vectors, iii angles between directions (cubic crystals), iv family of directions, <p>5.6 Explain lattice planes with reference to Miller indices.</p> <p>5.7 Describe Miller – Bravais indices (hexagonal crystals) with reference to:</p> <ul style="list-style-type: none"> i. intersection of planes, ii. direction within a plane. <p>5.8 Define diffraction in crystals.</p> <p>5.9 State the Bragg’s law.</p> <p>5.10 Describe diffraction patterns, diffraction lines and second – order diffraction in crystals.</p> <p>Perform calculations based on 5.9 above.</p>	<p>symmetry, lattice direction noting vector relationship, vectors, angles between directions and family of directions.</p> <ul style="list-style-type: none"> ◆ Explain Muller indices with emphasis on directions and plane of intercessions. ◆ Explain diffraction. ◆ State Bragg’s law and diffraction pattern and orders. ◆ State mathematical relationship. ◆ Solve calculations. 	<p>& H.C.P. Structures</p>			
<p>General Objective 6.0: Know structural disorders in materials</p>						

<p>12 - 13</p>	<p>6.1 Explain imperfections in crystals. 6.2 State the relevance of 6.1 in the properties of engineering materials. 6.3 Categorise imperfections into point defects, dislocation (linear defects) and boundaries (two-dimensional discontinuities). 6.4 Explain each of the imperfections in 6.3 above and their micro-structural consequences. 6.5 Perform calculations based on 6.3 above; e.g. energy of dislocations, grain boundary area & energies, and grain size. Describe the three-dimensional defects in amorphous or non-crystalline solids and their effects.</p>	<ul style="list-style-type: none"> ◆ Illustrate crystalline imperfections i.e. point defects, dislocation and grain boundaries. ◆ Explain their micro structural consequences. ◆ Derive expressions for dislocation and grain boundary energy and size. ◆ Explain defects in non-crystalline solids. ◆ Solve problems. 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard , Duster, Charts ◆ Model of Crystalline Arrangement with Defects. 			
<p>General Objective 7.0: Understand molecular phases.</p>						
	<p>7.1 Define micro and macro-molecules. 7.2 Give examples of each in 7.1 above.</p>	<ul style="list-style-type: none"> ◆ Illustrate micro and macro molecular phenomenon i.e. weight and length of 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, 			

14 - 15	<p>7.3 Determine by calculations molecular weights and length of polymer molecules.</p> <p>7.4 Explain the terms “micelles” and “folded chains ” in polymer crystallisations.</p> <p>7.5 Describe molecular variations with reference to side radicals, steric hindrance, stereo isomers and branching.</p> <p>7.6 Define unsaturated polymers, cis and trans-isomers and cross-linking.</p> <p>7.7 Give examples of the terms in 7.6 above.</p> <p>7.8 State the effects of 7.6 on the physical property of polymer materials.</p>	<p>polymer molecules, folded chains and crystallisation.</p> <p>◆ Explain molecular variation with examples of side radicals, stoic hindrance, stereo-isomers and branching.</p> <p>◆ Give examples of unsaturated polymers, as- and trans-isomers and cross linking</p>	Charts, phase diagrams, etc.			
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	WELDING METALLURGY
CODE:	WFC 106
DURATION:	HOURS/WEEK : 3hrs L – 1, P - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Welding Metallurgy.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand phase equilibrium in material system
- 2.0 Understand phase changes in metals
- 3.0 Know solid solution
- 4.0 Know strengthening process in metals
- 5.0 Know the effect of heat treatment on metals

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Welding Metallurgy			COURSE CODE: WFC 106		CONTACT HOURS: 1-0-2	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Welding Metallurgy.						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand phase equilibrium in material system					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 3	1.1 Define binary system. 1.2 Give examples of 1.1 (Cu-Zn; Steel Fe-C, etc.). 1.3 Explain material balance and the lever rule. 1.4 Illustrate 1.3 with Cu alloy system. 1.5 Derive the general term (level rule equation) for the weight ratios of any two phase x and y within a material of composition C_0 in which the phase composition are C_x and C_y ; i.e. $C_0(X + Y) = C_x X + C_y Y$. 1.6 Calculate weight fraction of a given binary system using	<ul style="list-style-type: none"> ◆ Explain binary system. ◆ Explain material balance and Lever rule. ◆ Solve calculations problem. ◆ Draw Fe-C diagram. ◆ Explain the diagram above. 	Recommended textbooks, Chalk/Chalkboard, Duster, Charts	1.1 Carryout experiment to determine the melting points of various metals & alloys.	Demonstrate for the students to learn and assess them.	

	<p>1.5 above.</p> <p>1.7 Define eutectic liquid, eutectic temperature and eutectic composition of a binary system.</p> <p>1.8 Draw Fe – C phase diagram.</p> <p>1.9 Use 1.8 to explain the following reactions:</p> <p>i. peritectic reaction;</p> <p>ii. eutectoid reaction;</p> <p>iii. peritectoid reaction</p>					
General Objective 2.0: Understand phase changes in metals						
4 - 8	<p>2.1 Define phase change.</p> <p>2.2 State three types of phase change involving no compositional change (e.g. congruent transformation, ordering and martensitic reaction).</p> <p>2.3 Describe the following congruent transformations:</p> <p>i. reconstructive transformation;</p> <p>ii. displacive transformation.</p> <p>2.4 Give examples of materials undergoing transformations in 2.3 above.</p> <p>2.5 Describe orderate</p>	<ul style="list-style-type: none"> ◆ Define phase changes. ◆ Describe congruent transformation. ◆ Explain TTT curve. ◆ Draw thermal equilibrium diagrams Pb-Sn. ◆ Explain the diagram above. ◆ Explain nucleation ◆ Assess the students. 	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts</p>	<p>2.1 Carryout experiment to distinguish between the solubility levels in a binary system.</p>	<p>Demonstrate for the students to learn.</p>	

	<p>transformation.</p> <p>2.6 Give example of 2.5 above.</p> <p>2.7 Describe shear (martensitic transformations with examples).</p> <p>2.8 Verify the effect of 2.7 on hardness of steel samples with different carbon content.</p> <p>2.9 Explain isothermal transformation of austenite.</p> <p>2.10 Draw transformation curves for:</p> <ul style="list-style-type: none"> i. transformation of austenite to pearlite (eutectoid steel). ii. transformation of austenite to ferrite plus pearlite. <p>2.11 Explain the curves in 2.10 above.</p> <p>2.12 Illustrate with diagrams the effect of alloy elements on the curves 2.10 above.</p> <p>2.13 Draw thermal equilibrium diagrams for Lead – Tin and Copper – Zinc alloy</p>					
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	<p>system.</p> <p>2.14 Explain 2.13 above.</p> <p>2.15 Define nucleation of phase change.</p> <p>2.16 State conditions for nucleation to occur.</p> <p>2.17 Derive expression for total free-energy required for a phase change.</p> <p>2.18 Draw diagram showing variation of nucleation free-energy with grain radius under:</p> <ol style="list-style-type: none"> i. homogeneous nucleation; ii. super cooling. <ol style="list-style-type: none"> a. Explain 2.18 above. b. Solve mathematical problems from 2.17. c. Define heterogeneous nucleation. d. State conditions for 2.20. <p>2.19 Relate 2.10 and 2.13 to welding situation</p>					
General Objective 3.0: Know solid solution						
	<p>3.1 Define solid solution.</p> <p>3.2 Classify solid solution.</p> <p>3.3 Describe each type of</p>	<p>◆ Define solid solutions.</p> <p>◆ Explain solid solutions.</p>	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts</p>	<p>3.1 Carryout experiment to distinguish between homogeneous and</p>	<p>Demonstrate for the students to learn and assess them.</p>	

9 - 10	<p>solid solution in 3.2 above.</p> <p>3.4 State Hume-Rothery's theory on solid solution.</p> <p>3.5 Explain interstitial solid solution and their to properties of steel.</p> <p>3.6 Name intermediate phases.</p> <p>3.7 Describe 3.6 above.</p>	<p>◆ classify solid solutions.</p> <p>◆ State Hume Rothery theory on solid solutions.</p>		heterogeneous systems.		
General Objective 4.0: Know strengthening process in metals						
11 - 12	<p>4.1 State the importance of strengthening processes in engineering.</p> <p>4.2 Name strengthening processes (e.g. solution treatment, mechanical deformation processes, precipitation processes, solid-state transformation).</p> <p>4.3 Explain the relationship of the processes in 4.2 with dislocation.</p> <p>4.4 Describe solution treatments.</p>	<p>◆ State and explain the importance of strengthening process in engineering.</p> <p>◆ Describe the strengthening processes.</p> <p>◆ Describe the mechanical deformation processes.</p> <p>◆ Describe natural and artificial ageing.</p> <p>◆ Assess the students.</p>	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
General Objective 5.0: Know the effect of heat treatment on metals.						
	<p>5.1 Define heat treatment.</p> <p>5.2 State the effects of</p>	<p>◆ Define heat treatment.</p> <p>◆ State types of heat</p>	Recommended textbooks, Chalk/Chalkboard,	5.1 Conduct test on strengthening process by mechanical and	◆ Perform heat treatment exercises for the	<p>◆ Asbestos Cloth.</p> <p>◆ Screw Press.</p>

<p>13 - 15</p>	<p>5.1 above. 5.3 Describe heat treatment methods. 5.4 Explain the associated features of each operation in 5.3. 5.5 Explain the application of heat treatment in welding practice. 5.6 Explain the defects caused by operations in 5.3. 5.7 State the remedies of 5.3 above.</p>	<p>treatment and their application. ◆ State the quenching media.</p>	<p>Duster, Charts, etc.</p>	<p>thermal applications. 5..2 Carry out various heat treatment processes</p>	<p>students and ask them to perform. ◆ Assess the students.</p>	<p>◆ Anvil, Hammer Tensometer, etc. ◆ Reference Textbooks. ◆ Heating Furnace. ◆ Containers of Sand, Water & Oil.</p>
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	WELD AND METAL CORROSION
CODE:	WFC 108
DURATION:	HOURS/WEEK : 4hrs L – 2, P - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Weld and Metal Corrosion.

GENERAL OBJECTIVE:

On completion of this course, students should be able to:-

- 1.0 Know the importance of corrosion.
- 2.0 Understand the principles of corrosion.
- 3.0 Know the common types of corrosion.
- 4.0 Know corrosion testing methods.
- 5.0 Know corrosion control and prevention techniques.
- 6.0 Know incidence of corrosion in petroleum and other industries.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: WELD & METAL CORROSION			COURSE CODE: WFC 108		CONTACT HOURS: 2-0-2	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Weld and Metal Corrosion.						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Know the importance of corrosion.				General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	Importance of Corrosion 1.1 Define corrosion. 1.2 Explain corrosion damage on materials. 1.3 Explain some beneficial cases of corrosion, e.g.:- - Batteries - Electro-chemical machining	Explain in details the meaning and importance of corrosion.	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
General Objective: 2.0 Understand the principles of corrosion.				General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
2 - 3	Corrosion Principles 2.1 Explain corrosion as an electro chemical process with particular reference to anodic and cathodic site corrosion. 2.2 Explain the environmental effects of corrosion. 2.3 State Tafel equation.	Explain in details with appropriate diagrams the principles and features of corrosion.	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.			

	2.4 Explain pour – Baix diagram and its relevance. 2.5 Describe Evans diagram. 2.6 Explain the metallurgical effects of corrosion.					
	General Objective: 3.0 Know the common types of corrosion.			General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
4 - 5	Types of Corrosion 3.1 Describe the occurrence and features of the following forms of corrosion:- - uniform attack - galvanic corrosion - crevice corrosion - pitting corrosion - intergranular corrosion - selective leaching - erosion corrosion - stress corrosion cracking - hydrogen damage - corrosion fatigue	Explain in details with appropriate diagrams the types of corrosion.	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
	General Objective: 4.0 Know corrosion testing methods.			General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Testing Methods for Corrosion	Illustrate with diagrams the	Recommended textbooks,			

6 - 7	4.1 Classify corrosion testing methods and equipment, stating their limitations. 4.2 Describe major testing methods. 4.3 Explain the standard expressions for corrosion rate.	methods for testing corrosion.	Chalk/Chalkboard, Duster, Charts, etc.			
	General Objective: 5.0 Know corrosion control and prevention.			General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
8 - 9	Corrosion Control and Prevention 5.1 Explain the principles underlying corrosion control and prevention. 5.2 Describe corrosion control and prevention techniques under the following:- - material selection - design - alteration of the environment - cathodic and anodic protection - coatings	Explain in details principles and techniques of corrosion control and prevention.	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
	General Objective: 6.0 Know incidences of corrosion in petroleum and other industries.			General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Incidence of Corrosion	Describe in details	Recommended			

10 -13	<p>6.1 Enumerate the corrosion rates of various sections of steel weldment.</p> <p>6.2 Give account of corrosion in the following petroleum operating regions:-</p> <ul style="list-style-type: none"> - down hole - topside facilities - pipelines - structures - hydrocarbon plant <p>6.3 Give account of corrosion in the steel, transportation and non-oil chemical industries.</p>	the incidences of corrosion in petroleum and other industries.	Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	BASIC ELEMENTS OF WELDING & FABRICATION DESIGN
CODE:	WFC 110
DURATION:	HOURS/WEEK : 4hrs L – 2, P - 2
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Welding & Fabrication Design.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

1. Understand need for weld design and its effects on welding cost.
2. Know the basic types of joints and welded joint features.
3. Understand the factors to be considered while designing a welded joint.
4. Know joints for brazing and soldering
5. Understand practical joint design for welding, brazing and soldering
6. Know the basic designs for sheet metal fabrication.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Basic Elements of Welding & Fabrication Design			COURSE CODE: WFC 110		CONTACT HOURS: 2-0-2	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Welding & Fabrication Design.						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand need for weld design & its effects on welding cost					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Define weld design and its advantages. 1.2 Explain the economic aspect of weld design. 1.3 Explain the influence of welding process on weld design	◆ Explain the need for welded joint design before actual fabrication and the consequences of not designing or wrong design. ◆ Explain the cost effect of design. ◆ Explain the effect welding process has on welded joint design.. Show how different welding processes should be used to weld a specific design and their suitability test through joint evaluation.	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
	General Objective 2.0: Know the basic types of joints and welded joint features					

<p>2 - 3</p>	<p>2.1 Describe the basic types of joints. 2.2 Explain types of welds. 2.3 Explain with aid of sketches the features of butt & fillet welds. 2.4 Describe with sketches the following joint preparation recommended for various arc welding processes: - flanged square butt, single V, single U, double-V, double- U, etc. 2.5 Describe the following edge preparation methods: - flame cutting (bevel or J penetration to give a V or U between butted plates). - planning (Bevel or J). - shearing (Bevel to maximum of 25mm thickness). - chipping.</p>	<p>◆ Explain the five basic types of joints ◆ Explain the limit of application of above. ◆ Explain the features of butt and fillet welds. ◆ Discuss why are butt & fillet are necessary. ◆ Illustrate the various fillet weld profiles. ◆ Illustrate the various edge preparations. ◆ Explain why different edge preparations are required. ◆ Describe the location of the features using different edge preparation methods to carry out a specific design and comparism made in terms of cost, quality of finish, cut profile and time. ◆ Illustrate weld</p>	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>			
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	<ul style="list-style-type: none"> - build-up by prior welding. <p>2.6 Demonstrate edge preparation using methods in 2.5 above.</p> <p>2.7 Explain with diagrams the following weld symbols:</p> <ul style="list-style-type: none"> - single-bevel butt - double-bevel butt - single-J butt - double-J butt - seating run - backing strip - dressed flush - full penetration butt weld from agreed welding procedure, etc. 	<p>symbols as represented on drawing.</p>				
General Objective 3.0: Understand the factors to be considered while designing a welding joint						
4 – 5	<p>3.1 Explain the factors under the following headings:</p> <ul style="list-style-type: none"> - service requirement, - types of loading, - type of edge preparation, - type of metal, - welding position and accessibility - cost of edge preparation. 	<ul style="list-style-type: none"> ◆ Explain the various factors that affect joint design. ◆ Explain type loading in relation to static, tensile, bending, torsion, manner of loading and failure modes as they affect joint or preparation type. ◆ Carry out single V edge preparation on two metal thickness 	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>			

		with the same specification to determine the effect on accessibility and strength				
General Objective 4.0: Know joints for brazing and soldering						
6 – 7	<p>4.1 Describe type of joints for brazing and soldering.</p> <p>4.2 Explain the braze joint design factors.</p> <p>4.3 Differentiate between braze and welded joints.</p>	<p>◆ Illustrate the basic joint types and edge preparations required for brazing and soldering.</p> <p>◆ Explain why are the above different from those used in welding</p>	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
General Objective 5.0: Understand practical joint design for welding, brazing and soldering						
8 - 10				<p>5.1 Carryout the design of weld joints for:</p> <ul style="list-style-type: none"> - welding operations - brazing and soldering operations. 	◆ Demonstrate design of joints and preparations required for welding, brazing and soldering.	Design instruments and calculator
General Objective 6.0: Know the basic designs for sheet metal fabrication.						
11 - 14	<p>6.1 Define the following terms used in sheet metal fabrications:</p> <ul style="list-style-type: none"> - template, - hems, edges, seams and self secured joints. <p>6.2 Draw single and double hem.</p> <p>6.3 Explain pattern development in fabrication.</p>	<p>◆ Explain why pattern development is necessary in sheet metal fabrication.</p> <p>◆ Explain why most sheet metal fabrication require self secured joints and stiffening.</p> <p>◆ Illustrate parallel line of radial line development as use</p>	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.	6.1 Carry out practical sheet metal fabrication using given data information	Demonstrate for the students to learn and assess them.	Marking out tools, Shearing machine, Guillotine, etc.

	6.4 Describe self secured joints in sheet metal fabrication. 6.5 Explain stiffening methods.	in triangulation to produce a two transition piece as is used in the development of a box shape, conical sections, etc.				
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	WELDING TECHNOLOGY AND PRACTICE
CODE:	WFC 112
DURATION:	HOURS/WEEK : 6hrs L – 2, P - 4
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Welding Technology and practice.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand equipment and accessories for welding
- 2.0 Understand different types of metal joining processes and their applications
- 3.0 Understand weld joints symbols and specifications.
- 4.0 Understand various types of hand tools and machines used in fabrication engineering.
- 5.0 Understand the workshop layout and use of jigs and fixtures in welding processes.
- 6.0 Understand the concept of power supply in arc welding
- 7.0 Know welding electrodes and its classifications
- 8.0 Understand the basic skills in striking and maintaining electric arc.
- 9.0 Know the skills in producing sound weld
- 10.0 Understand the causes and effects of hazards in manual arc welding

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Welding Technology & Practice			COURSE CODE: WFC 112		CONTACT HOURS: 2-0-4	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Welding Technology and practice.						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand equipment and accessories for welding					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	<p>1.1 Describe the characteristics of AC Welding Transformer, Rectifiers and the DC Welding Generator.</p> <p>1.2 Explain the function of Rectifiers (Straight and Reverse Polarity).</p> <p>1.3 Differentiate between AC and DC Welding Machines.</p> <p>1.4 Compare the advantages and disadvantages of 1.3 above.</p> <p>1.5 State the materials used for electrode coating and their functions.</p> <p>1.6 Describe Gas Welding/Cutting equipment and their operation.</p> <p>1.7 Describe the procedure for lighting welding torch, closing down and safety precautions.</p> <p>1.8 List hand tools that are used in welding operations.</p>	<ul style="list-style-type: none"> ◆ Explain the characteristics of AC/DC generators. ◆ Describe the functions of a DC generator. State the advantages/disadvantages in applications of DC over AC generator and vice versa. 	<ul style="list-style-type: none"> ◆ Chalk/blackboard, ◆ Pencil, drawing sheet, drawing board, ruler, triangle etc 	<p>1.1 Identify welding equipment in the workshop</p>	<p>Guide the students in the identification of welding equipment in the workshop.</p>	<p>Welding Machine and accessories.</p>

General Objective 2.0: Understand different types of metal joining processes and their applications						
3 - 4	<p>2.1 State methods available for joining metals (e.g. Mechanical, Soldering, Brazing and Welding).</p> <p>2.2 Define each of the methods in 2.1 above.</p> <p>2.3 State the applications and differences of the methods in 2.1 above.</p> <p>2.4 Classify welding processes into Fusion and Pressure types.</p> <p>2.5 Describe the following Fusion Welding Processes: Gas Method; Electric Method; Electron Beam Method; Thermit Method.</p> <p>2.6 Describe the following Pressure Welding Processes: Spot Welding; Seam Welding; Butt Welding; Flash Welding; Cold Welding.</p> <p>2.7 List the limitations in the items listed in 2.9 above.</p> <p>2.8 Describe soldering and brazing operations</p>	<ul style="list-style-type: none"> ◆ Introduce the students to the various joining processes. ◆ Describe the different joints e.g. tap and T-joints. ◆ Explain the applications and differences of each method in 2.1. ◆ Explain the application of gas pressure welding processes. ◆ Distinguish between soldering and brazing. ◆ Identify the various types of solder. ◆ Draw Lead-Tin alloy equilibrium system. ◆ Describe the behaviour and application of solder. ◆ State the alloy composition. 	<ul style="list-style-type: none"> ◆ Reference Books: ◆ Fabrication and welding engineering by F.J.M Smith. 	<p>2.1 Identify joints made from the methods in 2.1 above.</p> <p>2.2 Carry out simple Mechanical Joining.</p> <p>2.3 Carry out simple Fusion Welding using any of the methods in 2.5 above.</p> <p>2.4 Carry out simple pressure welding using any of the methods in 2.6 above.</p> <p>2.5 Carry out simple soldering and brazing operations.</p>	<p>Demonstrate activities 2.1 to 2.11 for the students to learn and allow them to practise.</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Various machines as listed.

	<p>including types of fluxes used.</p> <p>2.9 List types of tin-lead based solders, their compositions and solidification ranges.</p> <p>2.10 List types of brazing solders and silver solders, their compositions and freezing ranges.</p> <p>2.11 State the factors that affect the strengths of joints produced by the processes in 2.4, 2.5 and 2.6 above</p>					
General Objective 3.0: Understand weld joints symbols and specifications.						
5	<p>3.1 Identify various weld symbols.</p> <p>3.2 Interpret the symbols stated above using simple sketches as applicable to engineering drawings.</p> <p>3.3 Describe different weld joints</p>	<p>◆ Using sketches where necessary to explain 3.1-3.3.</p>	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>			
General Objective 4.0: Understand various types of hand tools and machines used in fabrication engineering.						
6 - 7	<p>4.1 State fabrication processes, equipment and necessary hand tools.</p> <p>4.2 Explain shearing.</p> <p>4.3 Explain working principles and uses of the following cutting machines:</p>	<p>Explain in details with diagrams and notes, the features and functions various hand tools and machines used in fabrication engineering.</p> <p>Assess the students.</p>	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>	<p>4.1 Identify the machines listed in 4.3 above.</p> <p>4.2 Select the correct machine to use for a given application</p> <p>4.3 Cut plate and sheet metal.</p>	<p>Demonstrate activities 4.1 to 4.3 for the students to learn and allow them to practise.</p> <p>Assess the students.</p>	<p>Guillotine; Nibbling Machine; Cropping Machine; Shearing Machine; Sawing Machine etc.</p>

	<p>Guillotine; Nibbling Machine; Cropping Machine; Shearing Machine; Sawing Machine etc.</p> <p>4.4 State advantages and limitations of the machines in 4.3 above.</p> <p>4.5 Explain bending action.</p> <p>4.6 Explain the working principles of the sheet metal forming machines: Fly-Press; Hydraulic Press; Press Brake; Folding Machine; Rolling Machine or Bending Rolls, etc.</p> <p>4.7 Describe the various operations carried out on the above machines: Bending; Edge Currying; Straightening; Bottoming; Folding; Rolling of sheet and plat material.</p> <p>4.8 State the advantages and limitations of the machines listed in 4.7 above.</p>					
General Objective 5.0: Understand the workshop layout, welding equipment and use of jigs and fixtures in welding processes.						
	5.1 Define manual arc welding.	◆ Explain manual arc welding.	Recommended Textbooks,			

8 – 9	<p>5.2 Explain a typical workshop layout for manual arc welding.</p> <p>5.3 Explain the functions of various part of a welding equipment.</p> <p>5.4 Use a simple sketch to explain manual arc welding circuit.</p> <p>5.5 Define jigs, fixture/manipulators and their uses.</p> <p>5.6 Explain the various methods in measuring temperature.</p>	<ul style="list-style-type: none"> ◆ Explain welding circuit, measuring temperature, instruments, jigs & fixtures. 	Chalk/Chalkboard, Duster, Charts, etc.			
General Objective 6.0: Understand the concept of power supply in arc welding						
10	<p>6.1 Define earthing and its importance.</p> <p>6.2 Explain voltage drops across the arc and transference of metal across the arc gap.</p> <p>6.4 Define the arc length.</p> <p>6.5 Explain the effect of arc length on welding voltage.</p> <p>6.6 Explain how to calculate welding voltage, current & resistance.</p> <p>6.7 Explain magnetic effects produced by current flow such as arc blow.</p> <p>6.8 Define transformer.</p> <p>6.9 Explain the function of transformer in welding.</p>	<ul style="list-style-type: none"> ◆ Explain earthing and its importance. ◆ Solve problems on welding voltage and resistance. ◆ Explain magnetic. ◆ Explain magnetic effects produced by current and arc blow. 	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
General Objective 7.0: Know welding electrodes and its classifications						

11	<p>7.1 Explain electrode classification according to (a) British Standard; (b) American Standard.</p> <p>7.2 Explain the importance of using welding electrode in its proper classified condition.</p> <p>7.3 Explain the function of electrode coatings.</p>	<ul style="list-style-type: none"> ◆ Emphasizes on electrode classification with reference to British & American standard. ◆ Explain and illustrate the problems encountered when damped electrodes are used. ◆ Explain the function of electrode coating. 	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>			
General Objective 8.0: Understand the basic skills in striking and maintaining electric arc.						
12 - 13	<p>8.1 Explain how to strike and maintain the arc.</p> <p>8.2 State and explain correct angle of electrode to the job.</p> <p>8.3 Define hard surfacing.</p> <p>8.4 Explain the reason for 4.4 above.</p> <p>8.5 Explain the effect of weather conditions on welding.</p> <p>8.6 Explain how to control residual stresses and method of stress relieving..</p> <p>8.7 Explain various methods of pipe welding.</p> <p>8.8 Explain the various welding positions and practically demonstrate the position in the</p>	<ul style="list-style-type: none"> ◆ Describe the process of striking and maintaining of arc. ◆ Explain hard surfacing and reasons for it. ◆ Solve problems on recovery rate of electrode. 	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>	<p>8.1 Strike and maintain arc for a given work.</p>	<p>Demonstrate show to strike and maintain the arc for the students to learn and allow them to practise.</p>	<p>Arc Welding Machine and accessories.</p>

	workshop. 8.9 Define preheating and post-heating and their importance. 8.10 Explain how to calculate the recovery rate of electrode					
General Objective 9.0 Know the skills in producing sound weld						
14	9.1 Define what is a sound weld. 9.2 Explain the role the following play to produce a sound weld: - metal edge preparation - selection of correct electrode - correct welding voltage and correct - correct welding speed - pre-heating - correct welding techniques - welding jigs, fixture and manipulators - proper cleaning of a weld before depositing another weld bead.	<ul style="list-style-type: none"> ◆ Emphasize the importance of a sound weld. ◆ Explain how a sound weld is produced. ◆ Explain the role of various parameters in the production of a sound weld. ◆ Assess the students. 	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.	9.1 Produced practically in the workshop a sound weld.	Demonstrate 9.1 for the students to learn and allow them to practice. Assess the students.	Arc welding machine and accessories.
General Objective 10.0 Understand the causes and effects of hazards in manual arc welding						
15	10.1 State the causes and effects of the various hazards in manual arc welding such as:	Explain in details the main causes and effects in manual arc welding.	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			

	<ul style="list-style-type: none">- eye – damaging radiation- burns- noxious fumes- electric shock- suffocation- explosions/fire	Assess the students.				
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	FABRICATION TECHNOLOGY AND PRACTICE
CODE:	WFC 114
DURATION:	HOURS/WEEK : 6hrs L – 2, P -4
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Fabrication Technology & Practice.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand fabrication technology basics
- 2.0 Understand sheetmetal work process
- 3.0 Know basic turning operations
- 4.0 Understand shaping operations
- 5.0 Know foundry processes
- 6.0 Understand forging operations
- 7.0 Know common threads used in engineering

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Fabrication Technology & Practice			COURSE CODE: WFC 114		CONTACT HOURS: 2-0-4	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Fabrication Technology & Practice.						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand fabrication technology basics					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Explain fabrication technology. 1.2 Explain factors to be considered before selecting assembly methods. 1.3 Explain the principle of vice operation with reference to - parallel vice; - leg vice.	◆ Explain in details the basic principles of fabrication technology.	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.	1.1 Use the following: - chiselling; - chopping out; - shearing; - chipping. 1.2 Use of the following files and filing. - flat files; - hand files; - half round files; - square files; - round files; - triangular or three-square files; - warding files; - needle files	◆ Practically demonstrate how to the use various types of files in the workshop.	◆ Fabrication Equipment
	General Objective 2.0: Understand sheetmetal work process					
2	2.1 Describe with illustration, sheet metal work process. 2.2 Explain the use of the following sheet metal work tools: - stakes - half-moon stake - hatchet stake	◆ Explain in details with diagrams sheet metal work process.	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.	2.1 Carryout preparation of safe edges.	◆ Demonstrate in the workshop the use of sheet metal tools in 2.2. ◆ Demonstrate how safe edges are made.	

	<ul style="list-style-type: none"> - creasing iron - round bottom or canister stake - Tinman's anvil - funnel stake. 					
	2.3 Explain safe edges.					
General Objective 3.0: Know basic turning operations						
3 - 4				<p>3.1 Perform the following using the centre lathe:</p> <ul style="list-style-type: none"> - facing operation - cylindrical turning - step turning - taper turning - boring - parting - knurling - reaming. <p>3.2 Carry out thread cutting operation on the lathe.</p> <p>3.3 Carry out exercises involving operations in 3.1 & 3.2</p>	<ul style="list-style-type: none"> ◆ Demonstrate thread cutting operation in the workshop. ◆ Assess the students. 	
General Objective 4.0: Understand shaping operations						
5 - 6				<p>4.1 Perform simple operations on shaping machine.</p> <p>4.2 Cut key-way, slots, etc on shaping machine.</p> <p>4.3 Select the correct work holding devices for different operations on the shaping machine.</p>	<ul style="list-style-type: none"> ◆ Demonstrate the operational principle of shaping machine in the workshop. 	

				4.4 Select appropriate tools for different shaping operations.		
General Objective 5.0: Know foundry processes						
7 – 8	<p>5.1 Explain foundry technology.</p> <p>5.2 Discuss the history of growth of foundry industry in some countries e.g. Britain, Germany, Russia, India & China etc..</p> <p>5.3 Discuss the role of foundry in technology development.</p> <p>5.4 Classify foundries based on type of production e.g.:</p> <ul style="list-style-type: none"> - cast iron industry - malleable iron foundries - non-ferrous foundries - jobbing foundries - captive foundries. 	<ul style="list-style-type: none"> ◆ Explain the term foundry technology. ◆ Explain the history of foundry industries in Nigeria. ◆ Discuss materials in 5.4. 	Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
General Objective 6.0: Understand forging operations						
9 - 11				6.1 Carry out exercises involving the following: <ul style="list-style-type: none"> a. hardening b. annealing c. tempering 	<ul style="list-style-type: none"> ◆ Demonstrate how to carry out stages in 6.1. ◆ Explain hand forging tools. ◆ Perform simple 	

				<p>d. normalising e. case-hardening.</p> <p>6.2 Select various hand forging tools & equipments for forge work.</p> <p>6.3 Perform forging operation involving cogging, bending, up-setting, twisting and punching.</p> <p>6.4 Carry out test on heat treated</p>	<p>operations involving cogging, bending etc.</p>	
General Objective 7.0: Know common threads used in engineering						
12 - 14	<p>7.1 Explain the following:</p> <p>a. Screw thread b. B.A threads (British Association) c. Square threads d. Acme threads e. Buttress threads f. Crest</p> <p>7.2 Root of a thread</p>	<p>◆ Explain in details with diagrams the features and application of the elements in 7.1.</p>	<p>Recommended Textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>	<p>7.1 Carryout thread cutting operation on centre lathe machine</p>	<p>Demonstrate for the students to learn and allow the to practise.</p> <p>Assess the students</p>	<p>Centre Lathe and accessories.</p>

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

THIRD SEMESTER

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	COMMUNICATION SKILLS
CODE:	GNS 201
DURATION:	HOURS/WEEK : 2hrs
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in comprehension, essay and summary writing.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the rudiments of communication
- 2.0 Understand the rules of grammar
- 3.0 Know how to write good essay
- 4.0 Understand the difference between denotative and connotative uses of words.
- 5.0 Understand the techniques of comprehension and summary writing.
- 6.0 Appreciating Literature in English

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Communication Skills			Course Code: GNS 201	Contact Hours: 2-0-0 Hrs/Wk		
Course Specification: Theoretical Contents						
WEEK	General Objective 1.0: Understand the rudiments of communication.					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Define Communication. 1.2 Analyse the process of Communication 1.3 Analyse 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, e.t.c. 1.6 Explain code- mixing, code-switching and dissonance in communication.	♦ Teachers are expected to involve the students in Communication Skills, and Speed intonation.	Recommended Textbook, Chalk/Chalkboard, Duster, Charts, etc			
General Objective 2.0: Understand the rules of grammar.						
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
2-3	2.1 Define the phrase 2.2 Explain the different types of phrases, i.e. structural and functional. 2.3 Define the clause 2.4 Explain the different types of clauses i.e. structural and functional.	Ask the students: ♦ To identify the different types of phrases. ♦ To define a clause and to identify the different types of clauses.	♦ Chalkboard, Duster, Recommended Textbooks ♦ Lecture Notes etc.			

	2.5 Define the sentence 2.6 Explain the different types of sentences, i.e. structural and function. 2.7 Explain the constitution of different types of sentences.	<ul style="list-style-type: none"> ◆ To define a sentence and to identify the different types of sentences. ◆ Assess the students on the construction of different types of sentences. 				
General Objective 3.0: Know how to write good essay.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
4-5	3.1 List the different types of essays. 3.2 Explain the features of each type of essay listed in 2.1 above. 3.3 Generate/gather relevant information on a given topic. 3.4 Draw up a good outline. 3.5 Write a good essay on a given topic.	<ul style="list-style-type: none"> ◆ Ask the student to list the different types of essays and to identify the features of each types of essay listed above. ◆ Assess the students on essay writing. 	<ul style="list-style-type: none"> ◆ Chalk and Blackboard, ◆ Duster ◆ Recommended Textbook ◆ Lecture Notes, etc. 			
General Objective 4.0: Understand the difference between denotative and connotative uses of words.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
6-8	4.1 Explain the term denotation. 4.2 Identify words used denotatively. 4.3 Explain the term connotation. 4.4 Identify words used connotatively. 4.5 Use word Connotatively. 4.6 Compare denotative and	<ul style="list-style-type: none"> ◆ Ask the students to define the terms denotation and connotation and how to identify words used denotatively connotatively. ◆ Assess the student. 	<ul style="list-style-type: none"> ◆ Chalk and Blackboard, ◆ Duster ◆ Recommended Textbook ◆ Lecture Notes, etc. 			

	connotative usage in groups of synonyms, e.g. women, lady, female, client, customer, patient, fear, terror, dread etc.					
General Objective 5.0: Understand the techniques of comprehension and summary writing.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
9-12	5.1 Answer questions on comprehension passage at a higher level of difficulty. 5.2 Give contextual explanations to statements from the texts used. 5.3 Identify colloquialisms, slangs and jargons. 5.4 Explain summary writing. 5.5 Distinguish between types of summary writing. 5.6 Explain the steps in summary writing. 5.7 Write, within a specified length, a goal summary of a given passage.	<ul style="list-style-type: none"> ◆ Ask the students to distinguish the various types of summary writing and the steps in summary writing. ◆ Give the students passages to summarise. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Chalk and Blackboard, ◆ Duster ◆ Recommended Textbook ◆ Lecture Notes, etc. 			
General Objective 6.0 Appreciating Literature in English.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
13-15	6.1 Describe drama. 6.2 Explain the types of drama. 6.3 Explain the terminology of drama, e.g. act, resolution, conflict, denouement, etc 6.4 Distinguish between radio drama and television drama.	<ul style="list-style-type: none"> ◆ Ask the students to identify the various types of drama and to explain the terminology of drama to differentiate between radio drama and 	<ul style="list-style-type: none"> ◆ Television, Video Cassette Recorder, ◆ Radio Cassette Player 			

	6.6 Answer an essay question On a given drama text.	television drama to answer essay question on a given drama text. ◆ Assess the students.				
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Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	COMPUTER AIDED DESIGN AND DRAFTING
CODE:	CAD 201
DURATION:	HOURS/WEEK : 3hrs L – 0, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in computer aided design and drafting.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand the use of computer in the design and drafting process.
- 2.0 Understand how to construct simple geometric shapes
- 3.0 Understand the different edit boxes.
- 4.0 Understand how to use edit commands
- 5.0 Understand how to create layers
- 6.0 Understand how to create linear and aligned dimensions.
- 7.0 Understand how to move, copy and rotate drawing parts

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Computer Aided Design And Drafting			Course Code: CAD 201		Contact Hours: 0-0-3 Hrs/Wk	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in computer aided design and drafting						
Course Specification: Theoretical Contents				Practical Content:		
General Objective 1.0: Understand the use of computer in the design and drafting process.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1 - 3	1.1 State the advantages and disadvantages of computer in the design process. 1.2 Explain the links between CAD and CAM. 1.3 Understand the principles of operation capabilities and system requirements of AutoCAD. 1.4 Identify the main parts of the screen of Auto CAD 14 or later version. 1.6 Explain the functions of the above. 1.7 Understand and use the different input methods: keyboards, mouse, digitisers, and scanners. 1.8 List the different coordinate systems.	<ul style="list-style-type: none"> ◆ Give overview of the use of computer in design and drafting. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Recommended Textbooks. ◆ Complete Computer Sets ◆ 1 Computer to 2 Students ◆ 1 Large Format Printer or ◆ Plotters in a Network ◆ 1 Digitiser to 2 students. 	1.1 Install the AutoCAD Software correctly. 1.2 Uses HELP Menu in solving problems when using the package. 1.3 Use the OSNAP facility to select options. 1.4 Use layer control to change the layers in a drawing. 1.5 Use Cartesian and Polar coordinates to draw lines. 1.6 Prepare and change the size of the drawing field. 1.7 Save drawings on demand and set up the auto-save features.	<ul style="list-style-type: none"> ◆ Provide the students the AutoCAD CDROM for the installation. ◆ Demonstrate activities 1.1 to 1.7 for the students to learn and allow them to practise. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Complete Computer Sets, 1 Computer to 2 Students, 1 Large Printer or Plotters in a Network, 1 Digitizer to 2 Students.

General Objective 2.0: Understand how to construct simple geometric shapes.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
4	2.1 Explain how to hatch the shapes drawn and change the hatch pattern and scale. 2.2 Explain how to draw circles, ellipse and arcs to given dimensions. 2.3 Explain how to construct polygons and squares.	◆ Explain in details the procedures involved in constructing simple geometric shapes.	◆ Recommended textbooks, Chalk/Chalkboard, Charts, Duster, etc.	2.1 Produce a simple drawing with simple geometric shapes.	◆ Demonstrate for the students to learn and allow them to practise. ◆ Assess the students.	◆ Complete computer sets, ◆ 1 computer to 2 students, ◆ 1 large format printer or plotters in a network, ◆ 1 Digitiser to 2 students.
General Objective 3.0: Understand the different edit boxes.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
5	3.1 Explain the different edit boxes, how to use them and their attributes. 3.2 Explain how to select the shapes using edit boxes. 3.3 Explain how to use the offset command.	◆ Describe in details the different edit boxes.	◆ Recommended textbooks, Chalk/Chalkboard, Charts, Duster, etc	3.1 Use array command to draw both polar and rectangular arrays.		PCs with AUTOCAD package
General Objective 4.0: Understand how to use edit commands.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
6	4.1 Explain how to use edit commands. 4.1 Explain how to move objects accurately; using both snap commands and coordinates. 4.2 Explain how to copy	◆ Explain in details how to edit commands.	◆ Recommended textbooks, Chalk/Chalkboard, Charts, Duster, etc	4.1 Move objects accurately; using both snap commands and coordinates. 4.2 Copy objects from one position to	◆ Demonstrate activities 4.1 to 4.4 for the students to learn and allow them to practise.	PCs with AUTOCAD package.

	<p>objects from one position to another accurately using snap and coordinate entry.</p> <p>4.4 Explain how to erase object.</p> <p>4.5 Explain how to trip objects.</p> <p>4.4 Explain how to fillet and chamfer angles.</p>			<p>another accurately using snap and coordinate entry.</p> <p>4.3 Erase object.</p> <p>4.4 Trim objects.</p>	<p>◆ Assess the students.</p>	
General Objective 5.0: Understand how to create layers						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
7-8	<p>5.1 Explain how to create layers.</p> <p>5.2 Explain how to change colour of layers.</p> <p>5.3 Explain how to change the line types of a layer.</p> <p>5.4 Explain how to move objects from one layer to another.</p> <p>5.5 Explain how to switch layers on and off.</p> <p>5.6 Explain the use of layers and how they help in the construction and understanding of a draw.</p>	<p>◆ Explain in details the procedures involved in creating layers.</p> <p>◆ Assess the students.</p>	<p>Complete Computer Sets</p> <p>1 Computer to 2 Students</p> <p>1 Large Format Printer or Plotters in a Network</p> <p>1 Digitiser to 2 students.</p>	<p>5.1 Create layers.</p> <p>5.2 Change colour of layers.</p> <p>5.3 Change the line types of a layer.</p> <p>5.4 Move objects from one layer to another.</p> <p>5.5 Switch layers on and off.</p> <p>5.6 Use of layers and how they help in the construction and understanding of a draw.</p>	<p>◆ Demonstrate activities 5.1 to 5.6 for the students to learn and allow them to practise.</p> <p>◆ Assess the students.</p>	<p>◆ Complete Computer Sets</p> <p>◆ 1 Computer to 2 Students</p> <p>◆ 1 Large Format Printer or Plotters in a Network</p> <p>◆ 1 Digitiser to 2 students.</p>
General Objective 6.0: Understand how to create linear and aligned dimensions.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
9-10	<p>6.1 Explain how to create linear and aligned dimensions.</p> <p>6.2 Explain how to create angular dimensions.</p> <p>6.3 Explain how to add to</p>	<p>Explain in details the procedures involved in creating linear and aligned dimensions</p>	<p>◆ Sets of Personal Computers</p> <p>◆ Recommended Textbooks</p> <p>◆ Manuals etc.</p>	<p>6.1 Add to tolerances to dimension.</p> <p>6.2 Create leader lines.</p> <p>6.3 Add single line and multiple line</p>		<p>◆ Complete computer sets,</p> <p>◆ 1 computer to 2 students,</p>

	<p>tolerances to dimension.</p> <p>6.4 Explain how to create leader lines.</p> <p>6.5 Explain how to add single line and multiple line texts to drawings.</p> <p>6.5 Describe how to edit dimensions and text.</p>			<p>texts to drawings.</p> <p>6.4 Edit dimensions and text.</p>		<p>◆ 1 large format printer or plotters in a network,</p> <p>◆ 1 Digitiser to 2 students.</p>
General Objective 7.0: Understand how to move, copy and rotate drawing parts						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
11 – 14				<p>7.1 Create the title block for a drawing Write letters and numbers on drawings</p> <p>7.2 Draw circles be able to erase parts lines or circles.</p> <p>7.3 Produce a simple drawing with correct details in terms of title block etc.</p> <p>7.4 Select parts of a drawing in order to do further work.</p> <p>7.5 Move, copy and rotate drawing parts.</p> <p>7.6 Produce a full drawing with title blocks from a real engineered</p>	<p>◆ Ask each student to carry out his/her own drawing.</p> <p>◆ Let each student carry out his/her own drawings.</p> <p>◆ Ask each student to carry out his/her own drawing.</p> <p>◆ Ask each student to carry out a drawing that is specific to his/her department.</p> <p>◆ Assess the students</p> <p>◆ Grade each student's drawing</p>	<p>◆ Complete Computer Sets</p> <p>◆ 1 Computer to 2 Students</p> <p>◆ 1 Large Format Printer or Plotters in a Network</p> <p>◆ 1 Digitiser to 2 students.</p>

				object. 7.7 Show all the views. 7.8 Produce a fully dimensioned drawing of a component appropriate to the engineering specification of the department.		
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Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	ENGINEERING MEASUREMENT
CODE:	WFC 201
DURATION:	HOURS/WEEK : 2hrs L – 2, P - 0
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in engineering measurement.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know the fundamentals of measurement
- 2.0 Understand the types and sources of errors.
- 3.0 Understand the constructional details of simple measuring instruments
- 4.0 Understand the principle of limit gauging
- 5.0 Know strain gauges, load cells and piezoelectric devices and their uses

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: ENGINEERING MEASUREMENT			Course Code: WFC 201		Contact Hours 0-0-3hrs/wk	
Course Specification: Theoretical Content				Practical Content		
Week	General Objective 1.0: Know the fundamentals of measurement.					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1-2	1.1 Describe workshop standards of length. 1.2 List the sub-divisions of standard of length. 1.3 Discuss the sub-divisions in 1.2.	◆ Explain in details the concepts and fundamentals of measurement.	◆ Recommended textbooks, charts, Chalkboard, chalk, etc.			
Week	General Objective 2.0: Understand the types and sources of errors.			General Objective 2.0: Identify sources of errors in measurement.		
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
3-4	2.1 Describe the types of errors commonly found in engineering measurement. 2.2 Explain sources of errors in measurement such as equipment errors, operational interference, and installation. 2.3 Explain means of overcoming errors mentioned in 2.1 above. 2.4 Describe drunken thread.	◆ Explain in details the types, sources and means of overcoming errors.	◆ Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.	2.1 Identify sources of errors in measurement such as equipment errors, operational interference, installation and ways of eliminating them.	◆ Demonstrate the activity in 2.1 and ask the students to identify the sources of error and suggest ways of overcoming them. ◆ Assess students' reports.	◆ Comparator, Limit gauges, steel rule, Dynamometers, Thermometer, etc.
General Objective 3.0: Understand the constructional details of simple				General Objective 3.0: Identify the Constructional details of		

	measuring instruments			simple measuring instruments.		
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
5-7	<p>3.1 Explain the principles of construction and operation of the following (a) dynamometer (b) bourdon tube manometers (c) thermometer, pyrometer, thermocouple etc.</p> <p>3.2 State the precautions to be observed when using the measuring instruments in 3.1 above.</p> <p>3.3 Differentiate between direct measurement and measurement by comparison</p>	<p>◆ Explain in details the features, operations and principles of construction of simple measuring instruments.</p> <p>◆ Assess the students' graded assignments.</p>	<p>◆ Chalk Chalkboard</p> <p>◆ Recommended textbooks, etc.</p>	<p>3.1 Identify the following:</p> <p>(a) Dynamometer (b) Bourdon tube Manometers (c) thermometer, (d) pyrometer, (e) thermocouple.</p> <p>3.2 Determine forces acting on a cutting tool using dynamometer.</p> <p>3.3 Determine the pressure in a vessel using the bourdon tube manometer.</p> <p>3.4 Determine the temperature in a cutting zone using a thermocouple.</p> <p>3.5 Determine the speed of a grinding wheel using a tachometer.</p> <p>3.6 Determine the flow of liquid in an orifice using a flow meter.</p>	<p>◆ Illustrate the activities in 3.1 to 3.6 and ask the students to carry out all the activities observing safety precautions.</p>	<p>◆ Dynamometer, Bourdon tube, Manometers, Thermometer, Pyrometer, Thermocouple, etc.</p>

	General Objective 4.0: Understand the principle of limit gauging.			General Objective 4.0: Demonstrate skills in limit gauge measurement and design.		
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
8-10	4.1 Explain the concept of calibration. 4.2 Describe the principles of calibrating (i) pressure gauges (ii) thermometers (iii) flow meters. 4.3 State the precautions to be observed during calibration of measuring instruments. 4.4 Define maximum and minimum metal limits. 4.5 Describe the limits of gauging. 4.6 State Taylor’s principle of gauging. 4.7 Give examples of principle of gauging.	◆ Explain in details the concept of calibration and limit gauging. ◆ Illustrate the precautions to be observed during calibration. ◆ Assess the students’ graded assignments.	◆ Recommended textbooks, charts, Chalkboard, chalk, Lecture notes, etc.	4.1 Calibrate pressure gauges, thermometer, etc. 4.2 Observe precautions during calibration. 4.3 Identify materials for gauges and its heat treatment. 4.4 Compare gauging with direct measurement. 4.5 Design a gauge.	◆ Demonstrate the activities in 4.1 to 4.5 for students to learn and ask the students to carry out the activities. ◆ Assess students’ reports	◆ Gauge apparatus and calibration kits
	General Objective 5.0: Know strain gauges, load cells and Piezoelectric devices and their uses.			General Objective 5.0: Demonstrate skills in the use of strain gauges, load cells and piezoelectric devices.		
Week	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
11-12	5.1 Describe various forms of strain gauges for	◆ Explain in details the	◆ Recommended textbooks,	5.1 Identify the following:	◆ Demonstrate the activities in 5.1	◆ Strain gauges, load cells,

	<p>measuring strains in radial, axial and biaxial directions</p> <p>5.2 Describe load cells and piezoelectric devices in measurement.</p> <p>5.3 Discuss the effect of heat and other environmental factors in the use of strain gauges.</p>	<p>principle of operation and application of strain gauges.</p> <p>◆ Assess the students.</p>	<p>charts, lecture notes, Chalkboard, chalk, etc,</p>	<p>a. Strain gauges b. Load cells c. Piezoelectric devices</p> <p>5.2 Make measurement with strain gauges and compare with other gauges.</p> <p>5.3 Make measurements with load cells, piezoelectric devices and compare with strain gauge measurement in terms of accuracy.</p>	<p>to 5.3 for students to learn and ask the students to carry out the activities.</p> <p>◆ Assess students' reports</p>	<p>piezoelectric devices, etc.</p>
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	UNDERWATER WELDING AND CUTTING TECHNOLOGY
CODE:	WFC 203
DURATION:	HOURS/WEEK : 5hrs L – 2, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Underwater Welding & Cutting Technology

GENERAL OBJECTIVE: On the successful completion of the course, the trainee should:-

- 1.0 Understand underwater welding process.
- 2.0 Understand underwater cutting.
- 3.0 Know the safety precautions to be observed in underwater welding and cutting.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Underwater Welding and Cutting Technology			COURSE CODE: WFC 203		CONTACT HOURS: 2-0-3	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Underwater Welding & Cutting Technology						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Understand underwater welding process.				General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1 - 3	Underwater Welding Process 1.1 Define underwater welding process. 1.2 Discuss the equipment used under the following:- - power source - positive operating safety switch - electrode holder - protective clothing - earthing 1.3 State and explain the procedure of underwater welding. 1.4 Compare weld produced underwater with that done on surface in terms of ductility and strength. 1.5 Explain why filet	<ul style="list-style-type: none"> ◆ Give definition of welding process. ◆ Show with diagrams the equipment in 9.2. ◆ Play a films of this equipment. ◆ Mention the process involved in underwater welding. ◆ List the advantages of underwater welding. ◆ Give reasons fro including filet in. 	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.	1.1 Identify the equipment used in underwater welding. 1.2 Identify underwater welds and its defects.	<ul style="list-style-type: none"> ◆ Take students on industrial visits where underwater welding operations are carried out. 	<ul style="list-style-type: none"> ◆ Charts ◆ Video clips ◆ Slides etc. ◆ Power source ◆ Positive operating ◆ Safety switch ◆ Protecting clothing ◆ Earthing ◆ Filed trips to access ◆ Show samples of underwater welds and those done in surface in terms of ductility and strength. ◆

	welds are usually recommended for all underwater welding.					
	General Objective: 2.0 Understand Underwater Cutting.			General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
4 - 6	<p>Underwater Cutting</p> <p>2.1 State the principles of operation for underwater cutting.</p> <p>2.2 State and explain the various underwater cutting processes.</p> <p>2.3 State and explain the main gas used in underwater cutting.</p> <p>2.4 Explain how to light the torch on land and how lighted torch may be lowered underwater.</p> <p>2.5 Explain how to light the torch underwater.</p> <p>2.6 Describe the actual cutting operation using either torch and surface cutting torch.</p> <p>2.7 Explain the difference between underwater cutting torch and surface cutting torch.</p> <p>2.8 Explain how the cutting flame will be tested before passing it on to the diver.</p> <p>2.9 Explain the meaning of</p>	<ul style="list-style-type: none"> ◆ List properties in 2.1. ◆ Mention various underwater cutting processes. ◆ Itemise the meaning. ◆ Demonstrate how to light the torch. ◆ Explain cutting operation using the 2 items used in 2.6. ◆ Compare the 2 methods mentioned in 2.7. ◆ Expansiate on the term 'drag techniques. ◆ Assess the students 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc. 	<p>2.1 Identify the equipment used in underwater cutting.</p>	<ul style="list-style-type: none"> ◆ Take students on industrial trips where underwater cutting operations are carried out. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Charts ◆ Video clips ◆ Slides etc. ◆ Gas samples ◆ Light torches ◆ Underwater site.

	term "drag technique" in underwater cutting. 2.10 State and explain points to remember always.					
General Objective: 3.0 Know safety precaution to be observed in underwater welding and cutting.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
7 - 10	The safety precaution to be observed in Underwater welding and Cutting 3.1 State and explain the sources of hazards in underwater welding and cutting. 3.2 State and explain all the safety precautions to be observed during underwater welding and cutting.	<ul style="list-style-type: none"> ◆ Mention all the hazards associated with underwater welding. ◆ Mention the safety measures to be observed while in underwater welding. ◆ Assess the students 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc. 			

Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	PLASTIC WELDING TECHNOLOGY
CODE:	WFC 205
DURATION:	HOURS/WEEK : 5hrs L – 2, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Plastic Welding Technology

GENERAL OBJECTIVE: On completion of this course, students should be able to:-

- 1.0 Understand the classification of plastic.
- 2.0 Know the assembly of plastic welding equipment.
- 3.0 Know plastic welding with electric and gas welding torches.
- 4.0 Know inspection and evaluation of plastic welds.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Plastic Welding Technology			COURSE CODE: WFC 205		CONTACT HOURS: 2-0-3	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Plastic Welding Technology						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: Understand the classification of plastics.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1 – 3	Plastic Classification 1.1 Define the two basic types of plastics. 1.2 Explain their characteristics and uses. 1.3 Explain their behaviour when heat is applied. 1.4 State engineering plastics that could be welded.	◆ Explain in details with diagrams and notes the classification and features of plastics.	◆ Recommended textbooks, duster, chalkboard, chalk, charts etc.	1.1 Identify different types of plastics.	◆ Demonstrate for students to learn.	◆ Charts ◆ Slides ◆ Video clips, etc.
General Objective: 2.0 Know the assembly of plastic welding equipment.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
4 – 6	Assembly of Plastic welding Equipment 2.1 List the equipment used in plastic welding. 2.2 Explain the functions of the various components of the equipment in 2.1 above.	◆ Explain in details the steps in assembling of plastic welding equipment.	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.	2.1 Identify equipment used in plastic welding. 2.2 Carry out the setting-up plastic welding equipment.	◆ Demonstrate activities in 2.1 – 2.2 for the students to learn and ask them to perform.	◆ Plastic welding equipment and accessories.

	2.3 Describe the setting up of plastic welding equipment.					
General Objective: 3.0 Know plastic welding with electric and gas welding torches.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
7 – 10	<p>Welding with Electric and Gas Welding Torches</p> <p>3.1 Describe electric and gas welding torches under the following:-</p> <ul style="list-style-type: none"> - effect of moisture or oil in the welding gas. - leaving electricity on when equipment is turned off. - proper earthing of the torch. - effect of volume of gas on welding temperature. - use of proper jet for the gas. <p>3.2 Explain how to prepare plastics for welding.</p> <p>3.3 Explain "lacking" in plastic welding.</p> <p>3.4 Explain how to start the weld.</p> <p>3.5 Explain the advantages of speed welding.</p> <p>3.6 Explain the advantages of speed welding.</p> <p>3.7 Explain common</p>	<ul style="list-style-type: none"> ◆ Illustrate activities in 3.1 – 3.8 in details with appropriate diagrams and notes. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>3.1 Carry out plastic welding using appropriate methods.</p> <p>3.2 Prepare plastic edges for welding.</p>	<ul style="list-style-type: none"> ◆ Demonstrate plastic welding before the students. ◆ Demonstrate the activities 3.1 and 3.2 for the students to learn and assess them. 	<ul style="list-style-type: none"> ◆ Plastics welding equipment and accessories.

	defects and how to prevent them.					
General Objective: 4.0 Know inspection and evaluation of plastic welds.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
11 – 15	Inspection and Evaluation of Plastic Welds 4.1 Explain the importance of testing a weld. 4.2 Explain the following factors that may affect the strength of the weld. <ul style="list-style-type: none"> - strength of the weld - temperature of welding gas - type of welding - preparation of plastic edge before welding - skill of the welder 4.3 State and explain the various testing methods.	◆ Illustrate in details 4.1 to 4.4 with appropriate diagrams and notes.	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.	4.1 Carry out plastic weld testing and evaluation using appropriate methods. 4.2 Identify the equipment used in plastic welding and evaluation. 4.3 Carryout testing and evaluations of plastic welds using appropriate methods.	◆ Demonstrate activities in 1.1 and 1.2 for the students to learn and assess them.	◆ Plastic welds testing equipment.

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	MACHINE TOOLS AND FORGING OPERATIONS
CODE:	WFC 207
DURATION:	HOURS/WEEK : 5hrs L – 2, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Machine Tools and Forging Operations

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

- 1.0 Know various machining operations on the centre lathe.
- 2.0 Know shaping operations on shaping machine.
- 3.0 Demonstrate skills in the use of milling machines.
- 4.0 Demonstrate skills in the use of different types of grinding machines.
- 5.0 Understand forging operations.
- 6.0 Know heat-treatment operations.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Machine Tools And Forging Operations			COURSE CODE: WFC 207		CONTACT HOURS:2-0-3	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Machine Tools and Forging Operations						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: centre lathe.				General Objective: 1.0 Know various machining operations on the		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1 – 2				Lathe Operations 1.1 Perform the following using the centre lathe:- facing operation cylindrical turning step turning taper turning drilling boring parting knurling reaming 1.2 Carry out thread cutting operations on the lathe. 1.3 Carry out exercises involving operations in 1.1 and 1.2	◆ Demonstrate for the students to learn and assess them.	◆ Lathe machine and accessories.
General Objective: 2.0 Know shaping operations on shaping machines						
WEEK	Specific Learning	Teachers Activities	Learning	Specific Learning Objective	Teachers Activities	Learning

	Objective		Resources			Resources
3 - 4				Shaping Operations 2.1 Perform simple operations on a shaping machine. Cut key-way, slots, etc., on shaping machines. 2.2 Select the correct work holding devices for different operations on the shaping machine. 2.3 Select appropriate tools for different shaping operations.	◆ Demonstrate for the students to learn and assess them.	◆ Shaping machine and accessories.
General Objective: 3.0 Demonstrate skills in the use of milling machines.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
5 - 7				Milling Machines 3.1 Select and mount different types of cutters for appropriate jobs. 3.2 Select and use various types of work and cutter holding devices for different types of jobs. 3.3 Perform milling exercises using the dividing head and index plates. 3.4 Carry out milling using the following methods:- - up milling - down milling - gang milling 3.5 Use tool grinder to	◆ Demonstrate for the students to learn and assess them.	◆ Milling machine and accessories.

				sharpen milling cutters.		
General Objective: 4.0 Demonstrate skills in the use of different types of grinding machines.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
8 - 9				Grinding Machine 4.1 Select work holding devices and use them on grinding machine. 4.2 Carryout different types of grinding operation. 4.3 Select the appropriate shapes, types and sizes of grinding wheels for various applications. 4.4 Balance grinding wheel. 4.5 Carry out wheel truing and dressing. 4.6 Perform grinding exercise involving surface cylindrical, taper, tool, crank shaft and internal grinding.	◆ Demonstrate for the students to learn and assess them.	◆ Forging tools and accessories.
General Objective: 5.0 Know forging operations						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
10 - 11				Forging Operation 5.1 Select various hand forging tools and equipment for forge work. 5.2 Perform forgoing operation involving cogging, bending, up-setting, twisting and	◆ Demonstrate for the students to learn and assess them.	◆ Forging tools and accessories.

				punching.		
	General Objective:			General Objective: 6.0 Understand heat treatment operations.		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
12 - 14				Heat Treatment 6.1 Carry out exercise involving the following:- - hardening - annealing - tempering - normalising - case-hardening 6.2 Carryout tests on heat treated metals.	◆ Demonstrate for students to learn and assess them.	◆ Electric furnace, ◆ Universal testing machine and accessories, etc.

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	FOUNDRY TECHNOLOGY & PRACTICE
CODE:	WFC 209
DURATION:	HOURS/WEEK : 5hrs L – 2, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Foundry Technology & Practice

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

- 1.0 Know the range of materials for pattern making and their relative cost and properties.
- 2.0 Know common methods of pattern making.
- 3.0 Know the application and the different types of patterns.
- 4.0 Understand the effects of clay and other additives to moulding sand.
- 5.0 Know mould and core making operations.
- 6.0 Know the criteria in the use of cupola and electric arc furnaces.
- 7.0 Understand the structure and properties of metal casting.
- 8.0 Know the factors affecting the characteristics of metal casting.
- 9.0 Understand the principles of casting non-ferrous alloys.
- 10.0 Understand fettling.
- 11.0 Understand modern methods of production.

- 12.0 Understand core making machine.
- 13.0 Understand special production processes and their economic considerations.
- 14.0 Determine the clay content of a clay-banded moulding sand.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: FOUNDRY TECHNOLOGY & PRACTICE			COURSE CODE: WFC 209		CONTACT HOURS: 2-0-3	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Foundry Technology & Practice						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know the range of materials for pattern making their relative cost and properties					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 List materials for pattern making. 1.2 List the properties required of pattern materials. 1.3 State pattern materials an the basis of overall economic advantage and optimum performance	<ul style="list-style-type: none"> ◆ Ask students to identify common pattern materials. ◆ Ask students to list properties required of pattern materials ◆ Ask students to compare various pattern materials in terms of properties required, economic advantage and performance 	<ul style="list-style-type: none"> ◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard 	1.1 Select pattern materials on the basis of overall economic advantage and optimum performance. 1.2 Carryout the production of pattern from solid materials. 1.3 Demonstrate the effects of dead burnt clay on mould materials. 1.4 Identify and operate the following moulding machines - jolting machine, sand slingers, squeezes, jolt-squeeze	<ul style="list-style-type: none"> ◆ Demonstrate activities 1.1 to 1.4 for the students to learn and ask to carryout all the activities. ◆ Assess the students 	<ul style="list-style-type: none"> ◆ Various pattern materials pattern making tools and machines

				machines, roll-over machines, pattern draws machines, silicate and chemical hardening dispensing machine		
General Objective 2.0: Know common methods of pattern making						
2	<p>2.1 Describes the preparation of pattern from solid materials</p> <p>2.2 Describe by means of diagrams the following pattern construction: thin frames segmental and lagged patterns.</p> <p>2.3 Describe the various methods of determine the position of lighting and supporting joints.</p> <p>2.4 Describe the methods of joining pattern materials by adhesives, soldering, brazing metal fastening and welding.</p>	<p>◆ Ask students to identify tools and mechanics for wood working.</p> <p>◆ Ask students to describe by diagram thin frames segmental and lagged patterns.</p> <p>◆ Ask students to describe how supporting joints are positioned.</p> <p>◆ Show the students the position of lighting and supporting joints.</p> <p>◆ Show the students the methods of joining pattern materials by adhesives, soldering, brazing, fastening and welding.</p>	<p>◆ Recommended text books, lecture notes</p> <p>◆ Chalk</p> <p>◆ Chalkboard</p>	<p>2.1 Identify the position of lighting and supporting joints.</p> <p>2.2 Identify methods of joining pattern materials by adhesive, soldering, brazing, fastening and welding.</p>	<p>◆ Demonstrate by showing the lighting and supporting joints.</p>	<p>◆ Pattern Making tools and machines</p>
General Objective 3.0: Know the application and the different types of patterns						
	<p>3.1 State the application of the types of pattern equipment.</p> <p>3.2 Describe the different</p>	<p>◆ Ask students to state</p> <p>1) types of pattern equipment</p> <p>2) their applications</p>	<p>◆ Recommended textbooks</p> <p>◆ Lecture notes</p> <p>◆ Chalk and</p>			

3	<p>types of patterns: rose patterns split patterns, skeleton patterns, cope and drag patterns, match plates in hard wood and metal.</p> <p>3.3 State the application of various patterns in 3.2.</p>	<ul style="list-style-type: none"> ◆ Ask students to describe the various types of patterns ◆ Ask students to identify their advantages and disadvantages 	<p>chalkboard, etc.</p>			
General Objective 4.0: Know the properties of silica sand and other refractory materials						
4	<p>4.1 Explain the effects of heat upon refractoriness and expansion characteristics of silica sand.</p> <p>4.2 State the advantages of using: Zirconite, chromite and other refractory materials in preference to silica sand for mould and core production</p>	<ul style="list-style-type: none"> ◆ Ask students to say what they understand by refractoriness. ◆ Ask students to describe the effects of heat on silica sand. ◆ Ask students to give the advantages of zirconite, chromite etc over silica sand 	<ul style="list-style-type: none"> ◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard 			
General Objective 5.0: Understand the effects of clay and other additives to moulding sand						
5	<p>5.1 Explain the influence of the following types of clay on the moulding properties of clay banded sand: Montmorillonite, bentonite, kaodinite, hydromica, polymineral clays, in naturally banded sands.</p> <p>5.2 State the effects of</p>	<ul style="list-style-type: none"> ◆ Ask students to explain the influence of types clay binders on properties of moulding sand. ◆ Ask students to give reasons for the use of additives in clay banded moulding sands. 	<ul style="list-style-type: none"> ◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard 			

	<p>heat on clay bonded sands as in 5.1</p> <p>5.3 Illustrate the effects of dead burnt clay bond on mould materials.</p> <p>5.4 State and explain the reasons for adding coal, pitch, oil, flour, dextrin and starch to clay banded moulding sands.</p>					
General Objective 6.0: Know mould and core making operations						
6	<p>6.1 Explain the following: (a) bedding in (b) parting down (c) mould reinforcement.</p> <p>6.2 Describe the following: (a) ramming boards (b) odd sides (c) floor boards (d) sloping pieces</p> <p>6.3 Describe snap flasks, slip flasks and special moulding boxes</p> <p>6.4 Describes the following (i) position of joint (ii) construction of pattern (iii) loose pieces (iv) core prints (v) core covers (vi) cone prints (vii) stopping off pieces (viii) template (ix) part-patterns.</p> <p>6.5 Describe methods of pattern and moulding</p>	<ul style="list-style-type: none"> ◆ Down and re-enforcement in moulding is done ◆ Ask students to: (1) identify ramming boards odd sides floor boards etc. (2) explain their uses ◆ Ask students to: (i) identify snap flasks, slip flask, etc (ii) explain how they are used ◆ Ask students to describe methods of pattern and moulding box alignment. ◆ Ask students to: (1) identify single and double-sided pattern plates, etc. (2) state 	<ul style="list-style-type: none"> ◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard 			

	<p>box alignment</p> <p>6.6 Explain the use of single and double-sided pattern plate (in metal and other materials) and stripping plates.</p> <p>6.7 Describe the following moulding machines: jolting machines, sand slingers, squeezes, jolt-squeeze machines, roll-over machines, pattern draw machines silicate and chemical hardening dispensing machine</p>	<p>their uses.</p> <ul style="list-style-type: none"> ◆ Ask students to (1) identify the moulding machines (2) Operate them ◆ Assess the students. 				
General Objective 7.0: Know the criteria in the use of cupola and electric arc furnaces						
7	<p>7.1 Review principle types of melting furnaces.</p> <p>7.2 Explain factors including causes that influence the choice of melting furnaces.</p> <p>7.3 Describe with diagrams the methods of heating and controlling the blast in a hot blast cupola.</p> <p>7.4 State the functions of the electrodes in an arc furnace.</p> <p>7.5 Explain the necessity for water cooling in arc furnaces</p>	<ul style="list-style-type: none"> ◆ Explain in details with appropriate diagrams and notes the principle of operations and use of cupola and electric furnaces. <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard 	<p>7.1 Carryout the layout of an electric and cupola furnaces including equipment and plant</p>	<p>Demonstrate for the students to learn and assess them.</p>	<p>Electric and cupola furnaces and accessories.</p>
General Objective 8.0: Understand the structure and properties of metal casting.						

8	<p>8.1 Draw and describe the iron carbon equilibrium diagram</p> <p>8.2 Classify cast iron.</p> <p>8.3 Describe the structure of white cast iron illustrating the main features</p> <p>8.4 Describe the structure of Grey cast iron illustrating the main features.</p> <p>8.5 Explain the reasons for the structural difference between white and grey cast irons by reference to phase diagram.</p> <p>8.6 Discuss the properties and give examples of uses of each category of cast iron.</p>	<ul style="list-style-type: none"> ◆ Ask students to: (1) Draw the iron carbon equilibrium diagram (2) And note it completely. ◆ Ask students to distinguish between white and grey cast iron. ◆ Ask students to say what they understand by malleable cast iron. ◆ Ask students to explain how grey and white cast irons are produced. ◆ Ask students to compare the properties ◆ Ask students to: (i) Compare their properties (ii) state their use 	<ul style="list-style-type: none"> ◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard 			
General Objective 9.0 Know the factors affecting the characteristics of metal casting.						
9	<p>9.1 State the effects of composition on casting temperature of plain carbon and low alloy steels.</p> <p>9.2 Describe how casting temperatures of steels affect the properties of mould and their materials.</p>	<ul style="list-style-type: none"> ◆ Ask students to explain the effect of temperature on mould and core materials. ◆ Ask students to describe the basic elements of the casting system. ◆ Ask students to 				

	9.3 Describe the running and feeding system necessary for plain carbon and low alloy steels.	<p>explain the use of riser, position in the mould, etc.</p> <p>◆ Ask students to”: (i) list the basic heat treatment procedures and (ii) describe them</p>				
General Objective 10.0: Understand the principles of casting non-ferrous alloys						
9	10.1 State the common effects of gas content in aluminium alloys	<p>◆ Ask students to: (i) list the common gas defects and (ii) state methods of controlling them</p>	<p>◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard</p>			
General Objective 11.0: Understand fettling processes						
10	11.1 Describe the methods for removing surplus metal from casting. 11.2 Isolate waste from re-cycle materials.	<p>◆ Ask students to (i) list the common fettling tools and machines (ii) state their uses</p>	<p>◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard</p>			
General Objective 12.0: Understand modern methods of production						
11 - 12	12.1 Explain universal or rotary table moulding machines. 12.2 Describe conveyor type automatic moulding lines to produce small or medium size castings. 12.3 Draw and explain metal pattern plates and master pattern plates. 12.4 Explain slip flask moulding and the use	<p>◆ Ask students to: (i) Describe the machines (ii) explain how they work.</p> <p>◆ Ask students to explain the necessity for automation.</p> <p>◆ Ask the students to describe slip flask moulding</p> <p>◆ Ask students to list the advantages of flask less moulding over flask moulding</p>	<p>◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard</p>			

	of automatic flask-less moulding machines of a high productive capacity. 12.5 Describe automatic lines which make flask less moulds with a vertically extending parting.	◆ Assess the students.				
General Objective 13.0: Understand core making machine						
13	13.1 Explain the goal of using core-making machines 13.2 Describe core-jarring machines 13.3 Sketch and describe core blowers.	◆ Use question and answer techniques in explanation.	◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard			
General Objective 14.0: Understand special production processes and their economic considerations						
14	14.1 Describe centrifugal casting. 14.2 Describe investment casting (lost-wax process). 14.3 Describe die casting. 14.4 Describe shell moulding. 14.5 Describe CONCAST. 14.6 Explain economic considerations of the various processes.	Explain in details with appropriate diagrams the production processes indicated in 14.1 to 14.6. Assess the students.	◆ Recommended text books, lecture notes ◆ Chalk ◆ Chalkboard			
General Objective: 15.0 Determine the clay content of a clay-banded moulding sand						
	15.1 Explain castings using sand moulds containing varying	◆ Ask students to explain clay content of clay - banded	◆ Recommended text books, lecture notes	15.1 Produce castings using sand moulds containing varying	◆ Demonstrate activities 15.1 to 15.5 for the	◆ Clay bonded moulding

15	<p>amounts of additives. 15.2 Explain moulds using different moulding technique 15.3 Explain cores using core boxes. 15.4 Calculate necessary alloy additions to adjust the composition of non-ferrous metals and then melt and carry out alloying.</p>	<p>moulding sand. ◆ Ask students to explain the design pattern for a given component drawing.</p>	<p>◆ Chalk ◆ Chalkboard</p>	<p>amounts of additives. 15.2 Produce moulds using different moulding techniques. 15.3 Produce cores using core boxes. 15.4 Calculate necessary alloy additions to adjust the composition of non-ferrous metals and then melt and carry out alloying. 15.5 Design patterns for sand moulding.</p>	<p>students to learning and ask them to carry out the activities.</p>	<p>sand, ◆ Standard jar ◆ Melting furnace, patterns Additives. ◆ Core sand ◆ Core boxes. ◆ Pattern material shrink rate. ◆ Pattern making tools</p>
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	STRUCTURAL STEELWORK
CODE:	WFC 211
DURATION:	HOURS/WEEK : Practical: 5
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate skills in Structural steelwork

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

1. Understand the safety rules as applicable to structural steel work
2. Understand the process of manufacture of iron and steel
3. Know how to use and care for Tools and Equipment used in Structural Steel Work
4. Know the structural properties of materials used in structural steel work and make simple calculations related to their strength
5. Know how to produce simple structural steel projects on the shop floor
6. Know how to assemble simple structural steel components
7. Know the effect of corrosion on structural steel materials and how to apply protective coating against corrosion.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN FABRICATION AND WELDING ENGINEERING						
MODULE: STRUCTURAL STEEL WORK		COURSE CODE: WFC 211		CONTACT HOURS: 5HRS		
GOAL: This course is designed to enable students acquire adequate skills in Structural steelwork						
Course Specification:		Theoretical content		Practical Content		
General Objective 1.0: Understand the safety rules as applicable to structural steel work.						
WEEK	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
1 – 2	<p>1.1 State the uses and care for the following protective wears used in structural steel work:</p> <p>a. gloves b. aprons c. boots d. goggles, etc</p> <p>1.2 Explain safety rules for the following operations in structural steel work:</p> <p>a) rules for storage of full and empty gas cylinders b) rules for lifting of structure</p>	<p>◆ State uses and care. ◆ Explain the safety for operations in structural steel work and give detailed notes.</p>	<p>◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>	<p>1.1 Apply the safety rules in carrying out operations named in 1.2 above.</p>	<p>◆ Demonstrate the application of safety rules in carrying out operations mentioned in 1.2 above</p>	<p>◆ Full and empty gas cylinders</p> <p>- structures - Protective wears.</p>

	c) rules for transporting of structures, etc.					
General Objective 2.0: Understand the process of manufacture of iron and steel						
	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning outcome	Teachers Activities	Learning Resources
3	<p>2.1 Sketch a blast furnace and describe its working principles</p> <p>2.2 Give the name of fuel and state the composition of charge used in blast furnace.</p> <p>2.3 Explain the working principles of Bessemer process with the aid of a sketch.</p> <p>2.4 Outline the characteristics of pig iron, cast iron and low carbon steel.</p>	<ul style="list-style-type: none"> ◆ Sketch and label a blast furnace and explain the working principles and ask students to do so. ◆ Ask students to state the types of fuel and the composition on charge used in blast furnace ◆ Ask students to state the working principles of a Bessemer process with the aid of a sketch ◆ List the characteristics of pig iron, cast iron and low carbon steel. 	<ul style="list-style-type: none"> ◆ Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc. 	<p>2.1 Visit an iron and steel industry factory to see a typical blast furnace.</p>		
General Objective 3.0: Know how to use and care for Tools and Equipment used in Structural Steel Work						
WEEK	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
4 - 6				<p>3.1 Select and use common hand tools used in structural steel work: e.g</p> <p>a) Hammers (assorted) sheers</p> <p>b) Spanners</p>	<ul style="list-style-type: none"> ◆ List common hand tools used in structural steel work. ◆ Explain their uses. ◆ Show students these tools and ask 	<ul style="list-style-type: none"> ◆ Tools listed in 2.1. ◆ Drawing papers ◆ Drawing instruments. ◆ Guillotine

				<p>(assorted) dog Drills (assorted) dice</p> <p>d) Punches dollies, etc</p> <p>e) Chisels</p> <p>f) Screw drivers</p> <p>g) Pliers</p> <p>h) Strips</p> <p>3.2 Identify and use with facility the following <u>Power tools</u> used in structural steel work: e.g.</p> <p>a) Riveting hammer (assorted)</p> <p>b) Holder on</p> <p>c) Impact wrenches</p> <p>d) Grinder</p> <p>e) Torque spanners</p> <p>f) Straight edge, etc.</p> <p>3.3 Identify, use and care for the following structural steel working equipment: e.g</p> <p>a) Cranes (assorted)</p> <p>b) Straightening machine</p> <p>c) Circular sawing machines</p> <p>d) Lofty platform</p> <p>e) Cropper</p> <p>f) Shearing machine</p> <p>g) Punching machines</p>	<p>student to sketch these tools.</p> <p>◆ List and explain the use of power tools used in structural steel work</p> <p>◆ Show the student these tools.</p> <p>◆ Demonstrate using these tools</p> <p>◆ Give detailed notes</p> <p>◆ List the equipment in 2.3.</p> <p>◆ Explain the use of each</p> <p>◆ List the equipment in 2.3</p> <p>◆ Explain the care of each equipment</p> <p>◆ Show the students each of this equipment physically where available. If not show them the pictures.</p> <p>◆ Ask student to produce diagram of each equipment</p> <p>◆ Give detailed notes</p> <p>◆ Demonstrate how to maintain tools, machines and <u>equipment</u> used in structural steel work as listed in</p>	<p>Bending machine</p> <p>◆ Power saw cutting</p> <p>◆ Power operated drilling machine.</p> <p>◆ Various pictures of</p> <p>◆ Cropper</p> <p>◆ Shearing machine</p> <p>◆ Oil and grease cans</p> <p>◆ Power bench</p> <p>◆ Grinding machine</p> <p>◆ Structural sheet working equipment listed 2.3</p> <p>◆ Various pictures of the structural steel working equipment.</p> <p>◆ Drawing papers</p> <p>◆ Drawing instruments.</p>
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				<ul style="list-style-type: none"> h) Drilling machine i) Guillotine j) Bending machine k) Rolling machine l) Brake pens m) Tape, twine and chalk n) Trammel <p>3.4 Maintain tools, machines and equipment used in structural steel work e.g by:</p> <ul style="list-style-type: none"> a) Cleaning b) Oiling c) Greasing d) Regrinding etc 	2.3	<ul style="list-style-type: none"> ◆ Structural sheet working equipment listed in 2.3. ◆ The tools machines and equipment listed in 2.3 ◆ Grease ◆ Oil ◆ Grinding machine ◆ The tools, machines and equipment listed in 2.3
General Objective 4.0: Know the structural properties of materials used in structural steel work and make simple calculations related to their strength						
WEEK	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
	<p>4.1 Describe with sketches the following forms of structural steel materials e.g</p> <ul style="list-style-type: none"> a) Plates (various 	<ul style="list-style-type: none"> ◆ Sketch and explain forms of structural steel materials. ◆ Give detailed notes on each of the 	<ul style="list-style-type: none"> ◆ Classroom facilities. ◆ Posters ◆ Charts. ◆ Classroom 	<p>4.1 Apply standard specifications, e.g Nigerian standard (where available)- American or British</p>	<ul style="list-style-type: none"> ◆ Apply standard specifications used in structural steel work design. ◆ Apply Hooke's 	<ul style="list-style-type: none"> ◆ Standard specifications

<p>7 - 8</p>	<p>thicknesses) b) Universal channel c) Universal beams d) Rolled steel joist e) T-bar f) Angle bar g) Check plates (assorted) h) Bridge beams, etc 4.2 Describe with sketches the following forms of structural steel materials: i. e.g plates (various thicknesses) j. universal channel k. universal beams l. rolled steel joist m. T. bar n. Angle bar o. Check plates (assorted) p. Bridge beams, etc. 4.3 Interpret conventional symbols and abbreviations used for representing structural steel sections 4.4 State the use and limitations of the structural steel materials named in 3.1 above 4.5 Distinguish between the following stresses in structural steel – work a. tensile stress</p>	<p>equipments. ◆ Asked students to sketch these equipment. ◆ Ask students to sketch and explain conventional symbols and abbreviations used in representing structural steel section ◆ Explain the use and limitations of the structural steel materials in 3.1 ◆ Explain and state the difference of stresses in structural steel work. ◆ Explain simple calculations involving practical application of stresses in riveted joint, welded joints etc.</p>	<p>facilities. ◆ Chart ◆ Text books</p>	<p>standards to structural steel work design. 4.2 Apply Hooke’s Law in the design of given simple structural elements. 4.3 Read structural steel work drawing and sketch simple structural steel work details.</p>	<p>Law in the design of simple structural elements ◆ Draw and interpret structural steel work drawing and sketches of simple structural steel work details</p>	
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	<p>b. compressive stress c. shear stress</p> <p>4.6 Solve problems on practical applications of tensile, compressive and shear stresses, e.g riveted and welded joints.</p>					
General Objective 5.0: Know how to produce simple structural steel projects on the shop floor						
WEEK	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
9 - 11	<p>5.1 Calculate allowances for forming thick metal or angle bar rings using the following methods:</p> <p>a. meanline method b. neutral line method</p>	<ul style="list-style-type: none"> ◆ Explain calculations of allowances for forming thick metal or angle bar rings using meanline and neutral line method ◆ Solve some problems 	<ul style="list-style-type: none"> ◆ Classroom facilities. 	<p>5.1 Produce simple projects in structural steel work e.g stanchion bar plate refter hunches, etc</p> <p>5.2 Develop templates with regular surfaces</p> <p>5.3 Cut out templates from the following materials:</p> <p>a. wood b. cardboard c. any other suitable materials</p> <p>5.4 Reproduce simple jobs on structural steel materials using templates</p>	<ul style="list-style-type: none"> ◆ Give students projects to demonstrate the production of simple projects in structural steel work. ◆ Demonstrate how to develop templates with regular surfaces. ◆ Demonstrate how to cut templates from various materials. ◆ Ask student to cut out template on wood, cardboard 	<ul style="list-style-type: none"> ◆ Welding machine ◆ Steel bar ◆ Electrode ◆ Flux etc ◆ Wood sad ◆ Razor blade ◆ Power sad ◆ Cutting machine ◆ Riveting machine ◆ Hammer ◆ Grinder

				cut in 4.3 above 5.5 Sketch and produce simple working jigs, e.g jig for mass production of stanchions, rafters, etc on the shop floor	etc. ◆ Give student Project to demonstrate how to reproduce simple jobs on structural steel materials using templates in 4.4 above ◆ Demonstrate how to sketch and produce simple working jigs. ◆ Ask students to do the same.	◆ Torque ◆ Spanner ◆ Crane ◆ Cropper ◆ Sheer machine ◆ Drilling machine ◆ Guillotine ◆ Bending machine rolling machine.
			◆ Classroom facilities.		◆ Take students to iron and steel industry/factory to see a typical blast furnace.	◆ Iron and steel industry factory.

General Objective 6.0 Know how to assemble simple structural steel components

WEEK	Specific Learning Outcome	Teacher Activities	Resource	Specific Learning Outcome	Teacher Activities	Resource
12	6.1 Explain the uses of fixtures and bolts in the assembly of structural components e.g bolting, riveting and welding	◆ Explain the uses of fixtures and bolts in the assembly of structural components ◆ Give detailed notes	◆ Class room facilities.	6.1 Assemble simple structural components such as tanks of different shapes, rafter bracing, simple canopy, simple roof trusses, etc using basic joining operations.	◆ Demonstrate how to assemble simple structural components, using bolts, rivets and welding operation. ◆ Show samples of some of the assemblies	◆ Welding machine ◆ Bolts ◆ Rivets ◆ Files etc

General Objective 7.0 Know the effect of corrosion on structural steel materials and how to apply protective coating against corrosion.

Week	Specific Learning Outcome	Teacher Activities	Resource	Specific Learning Outcome	Teacher Activities	Resource
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13 – 15	<p>7.1 Name some common causes of corrosion on steel e.g a. atmospheric b. chemical such as electrolytic action, etc</p> <p>7.2 Describe the effect of corrosion on structural steel, e.g a. weakening of structure b. defacing of steel</p> <p>7.3 Explain the purposes for applying undercoat to structural steel components</p> <p>7.4 State the composition of common undercoat used for structural steel work</p>	<ul style="list-style-type: none"> ◆ Ask students to list some common causes of corrosion on steel ◆ Ask students to explain the effects of corrosion on structural steel ◆ Explain the purposes for applying undercoat to structural steel components ◆ List and explain the composition of common undercoat used for structural steel work. 	<ul style="list-style-type: none"> ◆ Class room facilities. 	<p>7.1 Prepare the surfaces of structural steel components for finishing with the following methods:</p> <p>b. brushing c. de-greasing d. de-scaling</p> <p>7.2 Apply suitable undercoat to structural steel components. e.g red oxide metallization and observe necessary safety precaution</p> <p>7.3 Produce project while applying the safety rules in structural steel work.</p>	<ul style="list-style-type: none"> ◆ Demonstrate how to prepare the surface of structural steel components for finishing ◆ Ask the student to perform the operation above ◆ Demonstrate the application of suitable undercoat to structural steel components and observe safety precautions. ◆ Evaluate the students in the process of the production of project. 	<ul style="list-style-type: none"> ◆ Grinding machine ◆ Fillers ◆ Specimen ◆ Brush ◆ Paint etc ◆ Materials, tools and equipment listed in 7.1 and 7.2 above.
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Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

FOURTH SEMESTER

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	TECHNICAL REPORT WRITING & PRESENTATION
CODE:	WFC 202
DURATION:	HOURS/WEEK: 2 Hrs
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Technical Report Writing and Presentation

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand Content of a Technical Report
- 2.0 Know the methodology and sequence of writing technical report
- 3.0 Understand the information that is required in technical report writing
- 4.0 Understand and give good oral presentation

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Technical Report Writing & Presentation			COURSE CODE: WFC 202		CONTACT HOURS: 2-0-0	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Technical Report Writing and Presentation						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand Content of a Technical Report					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 3	1.1 Explain the meanings of technical reports. 1.2 Identify the purpose of technical reports. 1.3 Explain types and uses of technical reports.	<ul style="list-style-type: none"> ◆ Use questions and answer technique ◆ Give examples 	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.			
	General Objective 2.0: Know the methodology and sequence of writing technical report					
4 - 8	2.1 Explain the methods of determining the following in technical reports. <ul style="list-style-type: none"> a. determination of topic and title. b. justification of title. c. abstract or synopsis of the 	<ul style="list-style-type: none"> ◆ Lecture ◆ Give assignments 	Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.			

	<p>d. report. aim and objectives of the report.</p> <p>e. classification of data.</p> <p>f. scope and limitation of project.</p> <p>g. Data analysis (Graphical method, tabular method descriptive method).</p> <p>h. Presentation of data (use of appendices) clear.</p> <p>i. Explain how it should be made and corrected</p>					
General Objective 3.0: Understand the information that is required in technical report writing						
9 - 11	<p>3.1 Explain the various types of information that would be required in reports</p> <p>3.2 Determine the factors that influence solutions.</p> <p>3.3 Select criteria required in case studies.</p> <p>3.4 Produce summary.</p> <p>3.5 Make propositions (Author's Propositions).</p>	<p>◆ Use questions and answer technique</p> <p>◆ Give examples</p>	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>	<p>3.1 Determine critical analysis of case studies.</p>		

	<p>3.6 Develop conclusion to a technical report.</p> <p>3.7 Write a bibliography in standard format.</p> <p>3.8 Explain terms of reference in report.</p> <p>3.9 Explain the difference between facts and opinions.</p> <p>3.10 Explain how facts and opinions may be distinguished in writing report.</p> <p>3.11 Write reports on selected technical matters.</p> <p>3.13 Rewrite the abstract.</p>					
General Objective 4.0: Understand and give good oral presentation						
12 – 15	<p>4.1 Label a diagram of the organs of speech</p> <p>4.2 Describe the functions of the organs in 2.1 above in speech production.</p> <p>4.3 List the phonemes of English</p> <p>4.4 Produce correctly each of the phonemes listed in 2.3 above.</p> <p>4.5 Pronounce correctly by making distinctions between the different sound contrasts in the consonantal and vowel systems of English.</p>	<p>◆ Use questions and answer technique</p> <p>◆ Give examples</p>	<p>Recommended textbooks, Chalk/Chalkboard, Duster, Charts, etc.</p>			

	4.6 Explain the principles of effective speaking, viz; correct use of stress, rhythm, and information patterns. 4.7 Read fluently.					
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Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	DEVELOPMENT AND ASSEMBLY DRAWING
CODE:	WFC 204
DURATION:	HOURS/WEEK: 3 Hrs
UNITS:	2 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Development and Assembly Drawing.

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know the construction of different geometrical figures and shapes
- 2.0 Understand orthographic projections
- 3.0 Understand the developments and intersections of regular solids and planes

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Development and Assembly Drawing			COURSE CODE: WFC 204		CONTACT HOURS: 0-0-3	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know the construction of different geometrical figures and shapes					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 3				1.1 Carry out simple geometrical construction s of an ellipse e.g. Tangent to an ellipse at any given point on the ellipse, tangent to an ellipse from a given point 'p' outside the ellipse, etc 1.2 Divide areas of plane/figure. 1.3 Enlarge and reduce from the given areas of plane figure. 1.4 Define parabola and hyperbola. 1.5 Construct parabola and hyperbola using (a) Rectangular method (b) Ordinate method (c) tangent method (d) offset method. 1.6 Locate the directrix and focus of a given parabolic curve.	◆ Demonstrate activities in 1.1 – 1.10 for the students to learn and assess them.	◆ Black board ruler. ◆ Blackboard Tee Square ◆ Blackboard Set ◆ Squares 45°, 60° ◆ Black board Compass ◆ Black board Protractor ◆ Adjustable set square 45° Set Square 60° Set square ◆ Drawing Table, Pencil, Desk, Sharper

				<p>1.7 Construct a curve of a parabolic form through two given points.</p> <p>1.8 Define involute to a square, circle, cycloid and Archimedean spiral.</p> <p>1.9 Describe the various types of link mechanisms.</p> <p>1.10 Plot the locus of point e.g. (a) mechanism with a link constrained to pass through a fixed point (mechanism with the end of the link constrained to move in a horizontal link (c) three links mechanism (d) linkages of a mechanically operated lever system mechanism of a printing press (f) mechanism of a pair of secateurs</p>		<p>◆ Drawing Instrument Set</p>
General Objective 2.0: Understand orthographic projections						
4 - 7				<p>2.1 Identify the third plane (the auxiliary or side vertical plane) of projection.</p> <p>2.2 Project on it the end view of a three dimensional object.</p> <p>2.3 Sketch from an object (with changer, round hole, stepped, block, etc) the plane and</p>	<p>◆ Demonstrate activities 2.1 to 2.9 for the students to learn and assess them.</p>	<p>◆ Black board ruler.</p> <p>◆ Blackboard Tee Square</p> <p>◆ Blackboard Set</p> <p>◆ Squares 45°, 60°</p> <p>◆ Black board Compass</p>

				<p>elevations and draw the view in first and third angle orthographic Projections.</p> <p>2.4 Draw plan, elevations and sections of simple object such as hollow sand crate block.</p> <p>2.5 Explain the properties of a point, a line and plane in space.</p> <p>2.6 Locate given point, lines and planes in space on the projection planes.</p> <p>2.7 Determine the true length of a line in space using (a) auxiliary method (b) rotational Method.</p> <p>2.8 State Practical application's of the methods in 2.7 above.</p> <p>2.9 Apply successive auxiliary projections to determine the true position of a point to both horizontal and vertical planes the true horizontal and vertical planes the true shape of a plane inclined to both horizontal and vertical planes the shortest distance</p>		<ul style="list-style-type: none"> ◆ Black board ◆ Protractor ◆ Adjustable set square 45° Set Square 60° Set square ◆ Drawing Table, Pencil, Desk, Sharper ◆ Drawing Instrument Set ◆
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				between the two lines: The angle of inclination of a line inclined to two given planes			
	General Objective 3.0: Understand the developments and intersections of regular solids and planes						

<p>8 - 15</p>	<p>3.1 Define developments. 3.2 State the features of Developments.</p>	<p>◆ Illustrate 3.1 – 3.2 with diagrams and examples.</p>		<p>3.1 Develop pattern of regular solids such as truncated prism, prism, circular cylinder, truncated cylinder, frustum of a pyramid, truncated cone, etc 3.2 Draw the lines of intersections of the following regular solids and plane in both first and third angles i. a cylinder meeting a square pyramid at right angle ii. a cylinder meeting a cone, the cone at an angle iii. a cylinder meeting a cone, the cone enveloping the cylinder iv. a cylinder and a cone, the cylinder enveloping the cone v. A Square prism meeting a rectangular plane at an angle vi. A square prism meeting an ellipse at an angle vii. A square prism meeting a circle at an angle viii. A cylinder meeting a</p>	<p>◆ Demonstrate activities 3.1 to 3.7 for the students to learn and assess them</p>	<p>Black board ruler Blackboard Tee Square Blackboard Set Squares 45°, 60° Black board Compass Black board Protractor Adjustable set square 45° Set Square 60° Set square Drawing Table Pencil Desk Sharpener Drawing Instrument Set Drawing Table Adjustable Set square 45° Set square 60° Set square Pencil Desk Sharpener French curve set Drawing instrument set</p>
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				<p>pentagon at an angle</p> <p>ix. a cylinder meeting an ellipse at an angle</p> <p>x. a cone meeting an ellipse at an angle</p> <p>xi. a circle cutting through a pyramid at an angle</p> <p>xii. an ellipse being enveloped by a pyramid at an angle, e.t.c.</p> <p>3.4 Draw the patterns (developments) of the regular solids and planes in 3.3a-3.3e above.</p> <p>3.5 Draw the patterns (developments) of the regular solids and planes in 3.3f-3.3i</p> <p>3.6 Draw the patterns (development of the regular solids and planes in 3.3j-3.3 m</p> <p>3.7 Make models of the patterns referred to in 3.3a - 3.3e.</p>		
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Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	TESTING AND QUALITY CONTROL OF WELDS
CODE:	WFC 206
DURATION:	HOURS/WEEK: 4Hrs L-1, P-3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Testing and Quality Control of Welds

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know the need for weld testing.
- 2.0 Know two major methods of testing welds.
- 3.0 Understand classification of weld discontinuities.
- 4.0 Know various weld structural discontinuities.
- 5.0 Know the strength of various welded joints.
- 6.0 Know the various non-destructive testing methods.
- 7.0 Know how to evaluate weld defects.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Testing and Quality Control of Welds			COURSE CODE: WFC 206		CONTACT HOURS: 1-0-3	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Testing and Quality Control of Welds						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know the need for weld testing.					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Explain the importance of welds testing before putting it to service. 1.2 Explain typical weld failure mechanisms.	◆ Sketch a common welded object e.g. water tank with defects. ◆ Explain effect of defect on it. ◆ List common failure mechanism e.g. stress, corrosion, cracking etc.	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.			
	General Objective 2.0: Know two major methods of testing welds.					
2	2.1 Classify testing methods under:- - destructive testing - non destructive testing. 2.2 Explain various loading conditions for mechanical testing. 2.3 Describe the basic principle of mechanical methods of testing welds.	◆ Explain the testing methods. ◆ Explain the principles of: a. bend test b. tensile test c. hardness test d. impact test e. fatigue test f. creep test	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.	2.1 Conduct practical test of each of the mechanical testing methods in a given specimen.	◆ Demonstrate for the students to learn and assess them	◆ Guided Bend, Tensile, Hardness, Impact, Fatigue Testing Machines. ◆ 6mm Thick Plate, cut to

						size. ◆ Oxyflame, Emery Cloth ◆ Hacksaw, Work Bench. ◆ Files
General Objective 3.0: Understand classification of weld discontinuities.						
3 - 5	3.1 Define weld discontinuity. 3.2 State the difference between discontinuity and defect. 3.3 Classify weld defect under: - dimensional requirements - structural discontinuities - metallurgical/defective properties.	◆ Explain weld discontinuities. ◆ Explain defects.				
General Objective 4.0: Know various weld structural discontinuities.						
6	4.1 Define the different types of weld defects.	◆ Explain with sketches joints with weld defects.		4.1 Identify various weld defects. 4.2 Use wrong welding parameters to weld and produce joints with various weld defects.	◆ Demonstrate for the students to learn and assess them	
General Objective 5.0: Know the strength of various welded joints.						
7 - 8	5.1 Define strength of weld. 5.2 Determine the strength of a given weld by calculation. 5.3 Explain direct or shear stress as it affects the strength of a weld.	◆ Sketch geometrical features which may influence service				

	<p>5.4 Describe fatigue.</p> <p>5.5 Explain how 5.4 can affect the strength of a weld.</p> <p>5.6 Explain how rough metal edges, wrong choice of electrode/filler rod, welding flame etc. can effect the strength of welds.</p> <p>5.7 Explain the influence of weld defect on the strength of weld.</p>	<p>failures.</p> <p>◆ Solve problems</p>				
General Objective 6.0: Understand the dangerous effects of weld defects.						
9	<p>6.1 Explain the adverse effects of weld defects e.g. spillage, deformation of metal structures, brittle fracture, corrosion economic consequences.</p>	<p>◆ Illustrate in details with diagrams and notes.</p>				
General Objective 7.0: Know the various non-destructive testing methods.						
10 - 11	<p>7.1 Describe the basic principle of the following NDT methods:</p> <ul style="list-style-type: none"> - visual inspection - magnetic particle inspection - dye penetrant inspection - radiographic inspection - ultrasonic inspection 	<p>◆ Illustrate in details with diagrams and notes the NDT methods.</p>		<p>7.1 Carryout the following NDT methods:</p> <ul style="list-style-type: none"> - visual inspection - magnetic particle inspection - dye penetrant inspection - radiographic inspection - ultrasonic inspection 	<p>◆ Demonstrate for the students to learn and assess them</p>	<p>AWS weld gauge Electromagnetic yorke Particle powder X & Gamma ray equipment.</p>
General Objective 8.0: Know how to evaluate weld defects.						
	<p>8.1 Explain how non-destructive and destructive</p>	<p>◆ Illustrate in details the</p>				

12	<p>testing methods are used to identify and evaluate weld defects.</p> <p>8.2 Explain acceptable and unacceptable discontinuities with a given limit base on codes and standards.</p>	<p>processes of evaluation of welds.</p>				
General Objective 9.0: Know the categories and duties of a welding inspector.						
13 – 15	<p>9.1 Classify welding inspectors.</p> <p>9.2 Briefly explain duties of an inspector.</p> <p>9.3 Explain general welding symbols.</p> <p>9.4 Explain how to select specimen for weld test.</p> <p>9.5 State factors to be considered for effective report writing.</p> <p>9.6 Explain the importance of brevity, clarity.</p>	<p>◆ Illustrate in details.</p>	<p>◆ Reference Textbooks.</p> <p>◆ ASME Code IX.</p> <p>◆ API Code 1104</p>			<p>Tested Weld Samples Radiographs</p>

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	ADVANCED WELDING PROCESSES
CODE:	WFC 208
DURATION:	HOURS/WEEK: 5 Hrs L – 2, P - 3
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Advanced Welding Processes

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Know the general classification of arc welding
- 2.0 Understand manual arc welding and its auxiliary equipments
- 3.0 Understand the electrical aspect of arc welding
- 4.0 Understand electrode specification
- 5.0 Know the various manual arc welding techniques
- 6.0 Know the condition of sound weld
- 7.0 Understand causes of weld defects
- 8.0 Understand electrical resistance welding processes and their limitation
- 9.0 Know MIG, MAG, TIG welding processes
- 10.0 Know how to use other special welding processes.

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Advanced Welding Processes			COURSE CODE: WFC 208		CONTACT HOURS: 2-0-3	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Advanced Welding Processes						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know the general classification of arc welding					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Classify arc welding into carbon arc, metallic arc, submerge arc, gas shield arc (MIG/TIG) etc. 1.2 Describe briefly the processes in 1.1 above. 1.3 State the application of each processes in 1.1 above. 1.4 Explain the advantages and disadvantages of each process in 1.1 above.	◆ Explain the classification of arc welding into carbon arc, metal arc, submerge arc, gas shield arc, etc. ◆ State the application of above. ◆ Explain the advantages and disadvantages of each processes.	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.	1.1 Carryout arc welding on different joints.	◆ Demonstrate for the students to learn and assess them	◆ Mild Steel Plate. ◆ Arc Welding Equipment ◆ Jigs, Fixtures and Manipulators
	General Objective 2.0: Understand manual arc welding and its auxiliary equipments					
3	2.1 Define manual arc welding. 2.2 Explain a typical workshop layout for manual arc welding.	◆ With aid of a typical workshop layout, explain manual metal arc welding. ◆ Using simple	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster			

	<p>2.3 Explain the functions of the various parts of a welding equipment.</p> <p>2.4 Use a simple sketch to explain manual arc welding circuit.</p> <p>2.5 Define jigs, fixtures/manipulators and their uses.</p> <p>2.6 Explain the selection of welding current and the various methods for measuring welding temperature.</p>	<p>sketches explain the various parts of welding equipment & welding circuit.</p> <p>◆ Explain the uses of jigs, fixtures and manipulators.</p> <p>◆ Explain the selection of welding current.</p> <p>◆ Explain method of measuring welding temperature.</p>	<p>◆ Charts, etc.</p>			
General Objective 3.0: Understand the electrical aspect of arc welding						
4	<p>3.1 Define earthing.</p> <p>3.2 State the importance of earthing.</p> <p>3.4 Explain voltage drop across the arc and transference of metal across the gap.</p> <p>3.5 Define arc length.</p> <p>3.6 Explain the effect of arc length on the welding voltage.</p> <p>3.7 Explain how to calculate welding voltage, current, resistance and power.</p> <p>3.8 Explain magnetic effects produced by</p>	<p>◆ Explain earthing.</p> <p>◆ State the importance of 3.1 above.</p> <p>◆ Explain voltage drop across arc & transference of metal across gap.</p> <p>◆ Explain the calculation of welding voltage, current resistance and power.</p> <p>◆ Define arc length.</p> <p>◆ Explain the effect of arc length on welding voltage.</p> <p>◆ Explain the effect of current flow produced by a</p>	<p>◆ Recommended textbooks</p> <p>◆ Chalkboard</p> <p>◆ Chalk</p> <p>◆ Duster</p> <p>◆ Charts, etc.</p>	<p>3.1 Carryout welding with a transformer (AC).</p> <p>3.2 Carryout welding with a rectifier (DC).</p>	<p>◆ Demonstrate for the students to learn and assess them.</p>	<p>◆ Welding Machine.</p> <p>◆ Electrode AC/DC.</p> <p>◆ Mild Steel Plate</p>

	<p>current flow such as arc blow.</p> <p>3.9 Define transformer and rectifiers.</p> <p>3.10 Explain the function of 3.8 in welding.</p>	<p>magnet.</p> <ul style="list-style-type: none"> ◆ Explain transformer rectifier. ◆ Explain the function of transformer rectifier in welding. 				
General Objective 4.0: Understand electrode specification						
5 - 6	<p>4.1 Explain electrode classification according to :</p> <ul style="list-style-type: none"> - British standard, - American standard. <p>4.2 Explain the importance of using welding electrode in its proper classified condition.</p> <p>4.3 Explain the function of electrode coating.</p> <p>4.4 Explain the problem of welding with damped electrode.</p> <p>4.5 Explain the factors influencing selection of electrodes.</p>	<ul style="list-style-type: none"> ◆ Explain the classification of electrode according to British & American standard. ◆ Explain the importance of using electrode in its proper classified condition. ◆ Explain the function of electrode coating. ◆ Explain the factors influencing selection of electrode. ◆ Explain the problem of welding with a damped electrode. 	<ul style="list-style-type: none"> ◆ Damped electrode ◆ Dried electrode ◆ Mild Steel Plate 	<p>4.1 Carryout welding with a damped electrode.</p> <p>4.2 Carryout welding with electrode in a proper classified condition.</p>	<ul style="list-style-type: none"> ◆ Demonstrate for the students to learn and assess them. 	<ul style="list-style-type: none"> ◆ Different types of electrodes, welding machine and accessories
General Objective 5.0: Know the various manual arc welding techniques						
7 - 8	<p>5.1 Explain how to strike and maintain the arc.</p> <p>5.2 Explain the correct angle of electrode to the job.</p> <p>5.3 Define hard-surfacing materials.</p> <p>5.4 Explain the reason</p>	<ul style="list-style-type: none"> ◆ Explain how to strike and maintain arc. ◆ Explain the correct angle of electrode to the job. ◆ Explain hard surfacing materials used. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>5.1 Show practically in the workshop how to strike and maintain the arc.</p> <p>5.2 Show demonstrate the correct angle of electrode to a job.</p> <p>5.3 Show demonstrate the various welding positions using correct</p>	<ul style="list-style-type: none"> ◆ Demonstrate for the students to learn and assess them. 	<ul style="list-style-type: none"> ◆ Arc welding machine and accessories

	<p>for using 5.3..</p> <p>5.5 Explain how to control residual stresses.</p> <p>5.6 Explain the method of stress relieving.</p> <p>5.7 Explain various methods of pipe welding.</p> <p>5.8 Explain the various welding positions & techniques.</p> <p>5.9 define pre- and post heating.</p> <p>5.10 State the importance of 5.9 above.</p> <p>5.11 Explain how to calculate the recovery rate of electrode.</p> <p>5.12 Explain effect of weather conditions on welding.</p>	<ul style="list-style-type: none"> ◆ Give reason for using hard surfacing materials. ◆ Explain the control of residual stresses. ◆ Explain the method of stress relieving. ◆ With the aid of sketches, explain various pipe welding methods. ◆ Explain various welding positions. ◆ Explain the effect of weather condition on welding. ◆ Explain how to calculate the recovery rate of electrode. 		<p>techniques</p>		
General Objective 6.0: Know the condition of sound weld						
9 - 10	<p>6.1 Define a sound weld.</p> <p>6.2 Explain the following parameters on sound weld production:</p> <ul style="list-style-type: none"> - metal edge preparation - selection of the correct electrode - correct welding voltage and 	<ul style="list-style-type: none"> ◆ Explain a sound weld. ◆ Use various parameters to explain sound weld e.g. metal edge preparation, correct welding speed, etc. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>6.1 Produce sound weld in the workshop.</p> <p>6.2 Carryout the following in the workshop:</p> <ul style="list-style-type: none"> - build a pad on a mild steel plate, cut & micro etch the pad. - weld a single "V" butt weld prepare the weld 	<ul style="list-style-type: none"> ◆ Introduce students to the use of jig, fixture and manipulator in the workshop. ◆ Demonstrate selection of welding current. ◆ Demonstrate arc welding using jigs, fixture and manipulators 	<ul style="list-style-type: none"> ◆ Welding Machine. ◆ Jig, Fixture & Manipulator

	<ul style="list-style-type: none"> - current correct welding speed - pre-heating - correct welding technique - welding jigs, fixture and manipulations - proper cleaning of weld before depositing another weld bead. 			<ul style="list-style-type: none"> - and bend test it (emphasise on penetration and good edge preparation). - weld a double “V” butt weld. - weld fillet weld, fracture the weld and explain any defect found. - weld in various welding positions (down hand, vertical, horizontal and overhead). - weld pipe both straight, branch pipe & flange. - stainless steel welding. - cast iron welding. - hard surfacing. <p>6.2 Show with the use of jigs, fixture and manipulator to produce a sound weld</p>		
General Objective 7.0: Understand causes of weld defects						
11	<p>7.1 Explain how the following can cause weld defects:</p> <ul style="list-style-type: none"> - excess current - low current - edge preparation. 	<p>◆ Explain how weld defects can be caused by parameters listed in 7.1.</p>	<p>◆ Recommended textbooks</p> <p>◆ Chalkboard</p> <p>◆ Chalk</p> <p>◆ Duster</p> <p>◆ Charts, etc.</p>	<p>7.1 Carryout in the workshop the detection of weld defects by the parameters listed in 7.1 of theory.</p>	<p>◆ Demonstrate for the students to learn and assess them.</p>	<p>◆ Specimen of weld defects.</p>

General Objective 8.0: Understand electrical resistance welding processes and their limitation						
12 - 13	<p>8.1 Define resistance welding processes.</p> <p>8.2 Use various sketches to illustrate each process.</p> <p>8.3 Explain the operational principles of the processes in 8.1 above.</p> <p>8.4 Explain the importance of cleaning, degreasing, de-scaling on metal surfaces to be joined by resistance welding.</p> <p>8.5 Explain the method of heat energy application and mechanical force under the following:</p> <ul style="list-style-type: none"> - spot welding - flash butt welding, - seam welding, - resistance butt welding. <p>8.6 Undertake welding of metals using the methods in 8.5 above.</p>	<ul style="list-style-type: none"> ◆ With the aid of suitable sketches, describe resistance welding processes and their operational working principles. ◆ Using suitable diagram, explain the effect of heat energy application and mechanical force under spot welding, flash butt welding, seam welding and resistance butt welding. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>8.1 Carryout welding of metals using spot, seam, flash butt and resistance welding processes</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Demonstrate for the students to learn and assess them. 	<ul style="list-style-type: none"> ◆ Resistance welding equipment and accessories
General Objective 9.0: Know MIG, MAG, TIG welding processes						
	<p>9.1 Define MIG/MAG/TIG welding processes.</p>	<ul style="list-style-type: none"> ◆ Explain the MIG, MAG and TIG welding processes 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard 	<p>9.1 Demonstrate the use of the welding processes to weld</p>		<p>Various plates. Inert Gas CO₂, Argon, etc.</p>

<p>14</p>	<p>9.2 State the shielding gases used in the processes in 9.1 above and reason for their uses.</p> <p>9.3 Explain with aid of sketches the setting up of the equipment.</p> <p>9.4 Explain the function of each component.</p> <p>9.5 Explain the working principles of each process.</p> <p>9.6 Explain using a sketch volt – ampere curves.</p> <p>9.7 State advantages and disadvantages of each process in 9.1 above.</p> <p>9.8 Explain the operational techniques of the processes in 9.1 under the following:</p> <ul style="list-style-type: none"> - Spray arc, - Short arc circuiting, - Globular, - Wire feed speed and effect on current, - Voltage, - Choke of series induction, - Gas flow. <p>9.9 Use the processes in 9.1 above to weld the following:</p>	<p>with reference to the shielding gases used.</p> <ul style="list-style-type: none"> ◆ With the aid of diagram, explain the set-up of each equipment, their function and each component. ◆ Explain their operational techniques with reference to spray arc, short arc circuiting, globular, wire feed speed and effect on current, voltage, choke of series induction etc. ◆ Assess the students. 	<ul style="list-style-type: none"> ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>mild steel plate from 12mm thick aluminium and its alloys, stainless steel and pipe weld penetration bead.</p>		<p>Welding Machine</p>
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	<ul style="list-style-type: none"> - mild steel plate from 12mm - aluminium and its alloys - stainless steel - pipe weld penetration bead. 					
General Objectives 10.0: Know how to use other special welding processes.						
15	<p>10.1 Describe the working principles of the following special welding processes:</p> <ul style="list-style-type: none"> - Electro slag arc welding - Submerge arc welding - Atomic hydrogen arc welding - Ultrasonic - Induction electric - Thermit 	<ul style="list-style-type: none"> ◆ Explain the various special welding processes stated in 10.1. ◆ Acquit students with different equipment and tools to be used. ◆ Explain the safety precaution to be observed in the process of these operations. ◆ Assess the student. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>10.1 Carryout each of the special welding processes</p>	<p>Demonstrate for the students to learn and allow them to practise.</p> <p>Assess the students.</p>	<p>Welding machine. Materials e.g. electrode etc.</p>

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	ADVANCED FABRICATION PROCESSES
CODE:	WFC 210
DURATION:	HOURS/WEEK: 5 Hrs L – 0, P - 5
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Advanced Fabrication Processes

GENERAL OBJECTIVES: On completion of this course the students should be able to:-

- 1.0 Understand classification of metal working processes
- 2.0 Understand cold working.
- 3.0 Understand rolling of metals

PROGRAMME: National Innovation Diploma In Welding And Fabrication Engineering						
COURSE: Advanced Fabrication Processes			COURSE CODE: WFC 210		CONTACT HOURS: 0-0-5	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Advanced Fabrication Processes						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand classification of metal working processes					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 5	1.1 Define metal working. 1.2 Classify metal working into primary & secondary processes. 1.3 Relate metal working to elastic & plastic deformation. 1.4 Explain the effect of temperature on metal working processes. 1.5 Distinguish between hot and cold working.	<ul style="list-style-type: none"> ◆ Explain the classification of metal working into primary & secondary processes. ◆ Explain with aid of diagrams where necessary 1.3 –1.5. ◆ Conduct experiments on cold & hot working of metals. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			
	General Objective 2.0: Understand cold working.					
	2.1 Classify sheet metal forming processes. 2.2 Describe the	Explain in details with diagrams and notes the principles of Cold working.	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard 	2.1 Carryout the operations in 2.2 of theory using	<ul style="list-style-type: none"> ◆ Demonstrate operations in 2.1 using mild 	Anvil, hammers, guillotine,

6 - 9	<p>following sheet metal operations:</p> <ul style="list-style-type: none"> - shearing - bending - stretching - deep drawing, etc. <p>2.3 Explain the factors effecting deep draw-ability and stretch-ability of sheet metals.</p> <p>2.4 State deep-drawing defects and causes.</p> <p>2.5 Explain stiffening in fabrication of metal sheet and plates.</p> <p>2.6 Describe the following methods of stiffening sheet metal:</p> <ul style="list-style-type: none"> - wired edge - folded edge - swaging etc. <p>2.7 Describe the following methods of stiffening plates and structural members:</p> <ul style="list-style-type: none"> - web stiffening - troughing - channelling - ribbing. 		<ul style="list-style-type: none"> ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>mild steel and aluminium alloy sheet to produce suitable items.</p> <p>2.2 Carryout stiffening operations on sheet metal and plates</p>	<p>steel & aluminium alloy sheet to produce suitable items.</p> <ul style="list-style-type: none"> ◆ Demonstrate the operations of stiffening sheet, plates & structural members using the various methods in 2.7 & 2.8. ◆ Give exercises. ◆ Assess the students. 	<p>samples of sheet metals, etc.</p>
General Objective 3.0: Understand rolling of metals						
	3.1 Identify rolled	◆ Describe rolled products	◆ Recommended	3.1 Fabricate items	◆ Demonstrate	Anvil,

11 - 14	<p>products by their correct terminology.</p> <p>3.2 Classify rolling mills according to products.</p> <p>3.3 Classify rolling processes.</p> <p>3.4 Describe the continuous process for producing billets, bars, plates & metal sheets.</p> <p>3.5 State possible rolling defects on bars.</p> <p>3.6 Explain how to identify 2.5 above.</p> <p>3.7 Enumerate control measures for the defects in 2.5 above.</p> <p>3.8 State steel grades that can be rolled to produce the following:</p> <ul style="list-style-type: none"> - ribbed bars. - plain bars. - wire coils. <p>3.9 State uses of the products in 2.8 above in fabrication works.</p>	<p>by their correct terminology.</p> <ul style="list-style-type: none"> ◆ Identify possible defects on bars. ◆ Describe steel grades that can be rolled to produce the following: <ul style="list-style-type: none"> - ribbed bars - wire coils - plain bars. <p>Assess the students.</p>	<p>textbooks</p> <ul style="list-style-type: none"> ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	<p>using the products in 3.8 of theory.</p> <p>3.2 Apply appropriate joining techniques of 3.10 theory.</p>	<p>fabrication of items using the products in 3.7 above.</p> <ul style="list-style-type: none"> ◆ Give exercises. ◆ Assess the students. 	<p>hammers, guillotine, samples of sheet metals, etc.</p>
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Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	WELDING ECONOMICS AND MANAGEMENT
CODE:	WFC 212
DURATION:	HOURS/WEEK : 2rs L – 2, P - 0
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Welding Economics and Management

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

- 1.0 Know the importance of effective costing
- 2.0 Know the factors influencing welding costs
- 3.0 Understand how to reduce welding costs
- 4.0 Understand the calculation of cost of a welding project.
- 5.0 Know the meaning, importance, types and characteristics of maintenance system.
- 6.0 Understand the organisation of a maintenance department.
- 7.0 Understand preventive maintenance department.
- 8.0 Know the maintenance control procedures.
- 9.0 Understand maintenance report presentation.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: WELDING ECONOMICS & MANAGEMENT			COURSE CODE: WFC 212		CONTACT HOURS: 2-0-0	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Welding Economics and Management						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Know the importance of effective costing.				General Objective:		
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	Importance of Effective Costing 1.1 Define costing. 1.2 Explain effective costing under the following headings: - profit - workers bonus - replacement of equipment - purchase of modern equipment - organisation expansion - operational overhead	Explain in details the importance of effective costing.	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.			
General Objective: 2.0 Know the factor influencing welding costs.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Factors Influencing	Explain in details	◆ Recommended			

2	<p>Welding Costs</p> <p>2.1 Explain the factors under the following headings</p> <ul style="list-style-type: none"> - types of metal to be welded - types of welding electrode and size - electricity - oxygen - welding gases - welding fluxes - locations of weld - weld time - capital expenditure - depreciation of welding equipment - labour costs - metal edge preparation - pre-heating - post weld treatment - welding process used 	<p>the factors that influence welding cost.</p> <p>Assess the students.</p>	<p>textbooks</p> <ul style="list-style-type: none"> ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			
General Objective: 3.0 Understand how to reduce welding cost.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
3 - 4	<p>Reduction of Welding Cost</p> <p>3.1 Explain how good workshop layout can reduce welding cost</p> <p>3.2 State how motion economy can be achieved</p> <p>3.3 Explain the importance of using</p>	<p>Describe in details ways of reducing welding cost.</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			

	<p>correct welding technique</p> <p>3.4 Explain the need to use the correct welding process</p> <p>3.5 Explain the use of appropriate electrode and how to take proper care of electrode.</p>					
General Objective: 4.0 Understand the calculation of cost of welding project.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
5 – 7	<p>Calculation of Welding Cost</p> <p>4.1 Define fusion constant and explain how it can be used to calculate welding cost.</p> <p>4.2 Define fusion speed and how it can be used to calculate welding cost.</p> <p>4.3 Explain how to calculate the volume of a weld and then cost the weld per volume.</p> <p>4.4 Explain how to calculate the quantity of gas used and then calculate the cost of the gas used.</p> <p>4.5 Explain how to add the worker's pay to</p>	<p>Solve problems relating to calculation of welding cost of given projects.</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			

	4.6 the cost of the weld. Explain how to determine the percentage profit to be charged.					
General Objective 5.0 Know the meaning, importance, types and characteristics of maintenance system.						
8 – 9	5.1 Define maintenance. 5.2 State and describe Maintenance Strategies e.g. preventive, planned, breakdown, shut down, running and contract. 5.3 State the functions of each of the maintenance system. 5.4 State the advantages or benefits derived from a successful maintenance system. 5.5 Explain the importance of maintenance in industries.	Explain in details the meaning, importance, types and characteristics of maintenance system. Assess the students.	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			
General Objective 6.0 Understand the organisation of a maintenance department.						
10	Maintenance organisation 6.1 Define maintenance organisation. 6.2 Explain the maintenance services required within the company. 6.3 List the basic organisational guidelines for carrying out maintenance	Explain in details with notes and diagrams maintenance organisation.	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			

	function. 6.4 Describe the main levels of management that exist within the functions of the maintenance functions.					
General Objective 7.0: Understand preventive maintenance.						
11 - 12	<p>Preventive Maintenance</p> <p>7.1 Explain the problems involved in planning for preventive maintenance.</p> <p>7.2 State the advantages of preventive maintenance.</p> <p>7.3 Describe the methods of establishing preventive maintenance in an industry.</p> <p>7.4 Explain the methods of avoiding problems resulting from improper operating procedures of machines and equipment.</p> <p>7.5 Apply 7.4 above to welding and fabrication works.</p> <p>7.6 Explain the advantages of routine inspection.</p> <p>7.7 Identify the relevant equipment records for</p>	<p>Explain in details the meaning and principles of Preventive Maintenance.</p> <p>Give industrial illustrations.</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			

	<p>7.8 maintenance purpose. Analyse equipment records available in a welding and fabrication shop.</p> <p>7.9 Solve problems emanating from equipment records.</p>					
General Objective 8.0: Know the maintenance control procedures.						
13	<p>Maintenance Control Procedures</p> <p>8.1 Define maintenance control.</p> <p>8.2 Explain sources of control data and their inter-relationship.</p> <p>8.3 State the procedures for maintenance budgeting.</p> <p>8.4 Define operational controls.</p> <p>8.5 List and explain maintenance performance ratios.</p>	<p>Explain in details the meaning and principles of maintenance control procedures.</p> <p>Give industrial illustrations.</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			
General Objective 9.0: Understand maintenance report presentation						
14	<p>Maintenance Reports</p> <p>9.1 State guidelines for reporting to management.</p> <p>9.2 Develop a format for reporting and evaluating maintenance work.</p>	<p>Illustrate in details the procedures of presenting a good maintenance report.</p> <p>Assess the students.</p>	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 	9.1 Apply 9.2 above to maintenance of specific equipment/machines in a welding and fabrication shop.	Demonstrate for the students to learn and assess them	

Assessment: Exam 60%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	HEALTH, SAFETY & ENVIRONMENT
CODE:	WFC 214
DURATION:	HOURS/WEEK : 2hrs
UNITS:	3 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Welding and Fabrication Health, Safety & Environment

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

- 1.0 Understand the general principles of safety & environment protection in the welding & fabrication industry.
- 2.0 Understand that accidents are caused and that they are serious societal problems.
- 3.0 Understand causes of accidents
- 4.0 Understand the principles and techniques of accidents prevention and control.
- 5.0 Understand environmental pollution, causes, prevention and or control
- 6.0 Know safety Acts and Regulations
- 7.0 Know basic First Aid and components of First Aid Box

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: HEALTH, SAFETY & ENVIRONMENT			COURSE CODE: WFC 214		CONTACT HOURS: 2-0-0	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Welding and Fabrication Health, Safety & Environment						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Understand the general principles of safety & environment protection in the welding & fabrication industry.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	1.1 Explain the concept of safety. 1.2 State the positive characteristics of safety. 1.3 Enumerate the importance of safety.	◆ Illustrate the implications of unsafe acts using the home & the workshops.	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.			◆ Visits to Workshops & Industries. Video Films.
General Objective: 2.0 Understand that accidents are caused and that they are serious societal problems.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
2	2.1 Define accidents. 2.2 Examine types of accidents in welding & fabrication industry. 2.3 Explain the health, economic and societal effects of accidents.	◆ Explain accidents. ◆ Enumerate types of accidents on the worker, his family, the organization, etc..	◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc.			

General Objective: 3.0 Understand causes of accidents						
	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
3 – 5	<p>3.1 Define the term horse play.</p> <p>3.2 Explain how 3.1 above cause accidents.</p> <p>3.3 Explain the effect of skill acquisition on accidents.</p> <p>3.4 Define fire.</p> <p>3.5 State the various classes of fire and their extinguishers.</p> <p>3.6 Define back-fire and flash back as obtained in oxy-acetylene welding process.</p> <p>3.7 State causes and prevention of back-fire and flash back.</p> <p>3.8 Explain the following preventable workshops accidents: electric shock, explosions and burns.</p> <p>3.9 Explain the use of correct tools in accident prevention.</p>	<p>◆ Explain what constitute horse play and its consequences.</p> <p>◆ State the role of skill in performance and how lack of it effects us.</p> <p>◆ Explain fire, its types, causes, prevention and extinguishing.</p> <p>◆ Demonstrate back-fire in the workshop.</p> <p>◆ Explain how flash back arrestor could be installed and its uses.</p> <p>◆ Emphasise proper handling of electrical appliances and machines as well as proper handling and storage of highly inflammable and explosive materials.</p>	<p>◆ Recommended textbooks</p> <p>◆ Chalkboard</p> <p>◆ Chalk</p> <p>◆ Duster</p> <p>◆ Charts, etc.</p>			

General Objective: 4.0 Understand the principles and techniques of accidents prevention and control.						
	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
6	4.1 Explain the importance of accurate accident reporting and recording. 4.2 Explain the importance of charts, cartoons and signs as means of accidents prevention.	<ul style="list-style-type: none"> ◆ Enumerate the need for accident reports and record in organizations. ◆ Use charts cartoons and signs to build up safety consciousness 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			
General Objectives 5.0: Understand environmental pollution, causes, prevention and control						
	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
7 – 9	5.1 Define environmental pollution. 5.2 State types and sources of pollution and their control. 5.3 Explain the effects of pollution on the environment. 5.4 Explain the contribution of welding and metal fabrication to the pollution of the environment.	<ul style="list-style-type: none"> ◆ Explain the environment and what it takes to pollute it. ◆ Give types and sources of pollution. ◆ Enumerate various welding and ancillary activities and how their discharge fail or pollute the system. 	<ul style="list-style-type: none"> ◆ Recommended textbooks ◆ Chalkboard ◆ Chalk ◆ Duster ◆ Charts, etc. 			
General Objectives 6.0: Know safety Acts and Regulations.						
	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	6.1 Explain the role of	◆ Discuss the	◆ Recommended			

10 - 11	<p>government in environment protection and control.</p> <p>6.2 Explain factory safety acts and regulations.</p> <p>6.3 Make use of references to the appropriate Nigerian, British and American Safety Standards and Regulations.</p>	<p>government agents saddled with environmental protection.</p> <p>◆ Survey Factory Ordinances and Safety Regulations.</p> <p>◆ Examine the role of the Department of Petroleum Resources in checking environmental pollution</p>	<p>textbooks</p> <p>◆ Chalkboard</p> <p>◆ Chalk</p> <p>◆ Duster</p> <p>◆ Charts, etc.</p>			
General Objective 7.0: Know basic First Aid and components of First Aid Box						
12 - 13	<p>7.1 Define First Aid</p> <p>7.2 State Reasons for first Aid</p> <p>7.3 List the components of First Aid Box..</p> <p>7.4 Explain the procedures in administering First Aid.</p>	<p>Illustrate in details first aid, reasons for it, component of first aid box and procedures of administering first aid.</p>	<p>◆ Recommended textbooks</p> <p>◆ Chalkboard</p> <p>◆ Chalk</p> <p>◆ Duster</p> <p>◆ Charts, etc.</p>			

Assessment: Exam 40%, Practical 20%, Course Work 20%, Test 20%

PROGRAMME:	NID IN WELDING AND FABRICATION ENGINEERING
COURSE:	INDUSTRIAL WORK EXPERIENCE
CODE:	SIWE 200
DURATION:	4 MONTHS
UNITS:	6 Units
GOAL:	This course is designed to enable students acquire adequate knowledge and skills in Industrial Work

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

- 1.0 Know the Structure and the Management set up of the establishment
- 2.0 Know the general safety regulations of the establishment
- 3.0 Know the utility services required for the operations of the establishment
- 4.0 Understand production operations
- 5.0 Know the need for proper installation of welding & fabrication equipment
- 6.0 Know operational procedures of welding & fabrication equipment
- 7.0 Know the need for maintenance of welding & fabrication within the organisation
- 8.0 Know practical skills in various welding & fabrication process

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN WELDING AND FABRICATION ENGINEERING						
COURSE: Student Industrial Work			COURSE CODE:		CONTACT HOURS	
GOAL: This course is designed to enable students acquire adequate knowledge and skills in Industrial Work on Welding and Fabrication.						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 1.0 Know the Structure and the Management set up of the establishment						
WEEK	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
	Structure and Management of Establishment 1.1 Discuss the historical perspective of the organisation. 1.2 Draw the organisation chart of the establishment. 1.3 Explain the functions of each of the components in the organisational chart. 1.4 Explain the organisational of engineering department to which the student is posted. 1.5 Discuss the method of assigning jobs in the department.	Illustrate in details with appropriate diagrams. Assess the students.				Establishment organogram.
General Objective: 2.0 Know the general safety regulations of the establishment						

WEEK	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
				General Safety Regulations 2.1 Apply various safety measures in operation within the organisation/establishment. 2.2 Use various safety colour codes in the establishment. 2.3 Apply first aid instruction. 2.4 Apply safety service/measures required to performing various engineering operations. 2.5 Operate fire fighting equipment.	Demonstrate for the students to learn and them to practise. Assess the students.	
General Objective: 3.0 Know the utility services required for the operations of the establishment						
WEEK	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
				Utility Services for the Operations of the establishment. 3.1 Operate the equipment concerned with generation, transmission, and utilisation of the following: a. steam b. compressed air c. water supply (hot and cold) d. waste disposal(solid, liquid and gaseous) 3.2 Operate the electrical	Demonstrate for the students to learn and them to practise. Assess the students.	

				power generating equipment. 3.3 Diagnose the maintenance need of all the utilities equipment.		
General Objective: 4.0 Understand production operations						
WEEK	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
				<p>Production Operations</p> <p>4.1 Carryout jobs that involve fitting operations eg: (a) marking out, (b) cutting of metals, using hacksaw and chisels, (c) filing, scraping, polishing, etc, (d) drilling, reaming, (e) diesing, tapping.</p> <p>4.3 Carryout soldering, brazing, welding and forging operations.</p> <p>4.4 Operate stamping and punching machines.</p> <p>4.5 Carryout casting operations such as sand casting involving pattern making, moulding, melting, casting, fettling and investment casting, etc.</p> <p>4.6 Carryout machining operations involving: (a) turning and threading on the lathe, (b) drilling, reaming</p>	<p>Demonstrate for the students to learn and them to practise.</p> <p>Assess the students.</p>	

				<p>and boring, (c) milling, gear and cam milling, (d) shaping and planning, (e) grinding, lapping and honing.</p> <p>4.6 Detect out faults/defects in gauges, tools and raw materials.</p> <p>4.7 Check finished product for dimensional accuracy and texture.</p> <p>4.8 Participate in the assembly lines of components.</p> <p>4.9 Produce working drawing for the production of components.</p>		
General Objective 5.0 Know the need for proper installation of welding & fabrication equipment						
	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
				<p>Installation of Welding & Fabrication Equipment</p> <p>5.1 Participate in the preparation of foundation according to specification.</p> <p>5.2 Participate and level the plant/equipment on the foundation.</p> <p>5.3 Carryout alignment on the machine.</p>	<p>Demonstrate for the students to learn and them to practise.</p> <p>Assess the students.</p>	
General Objective 6.0 Know operational procedures of welding & fabrication equipment						
	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources

				Operational Procedures of Welding & Fabrication equipment 6.1 Carryout starting procedures. 6.2 Run the equipment/plant, observe, and interpret the control indicator 6.3 Carryout shut down operations. 6.4 Carryout emergency shutdown operations.	Demonstrate for the students to learn and them to practise. Assess the students.	
General Objective 7.0 Know the need for the maintenance of welding & fabrication within the organisation						
	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
				Maintenance of Welding & Fabrication 7.1 Determine various types of maintenance operations within the establishment. e.g planned, preventive and breakdown maintenance. 7.2 Carryout simple maintenance operations	Demonstrate for the students to learn and them to practise. Assess the students.	
General Objective 8.0 Know practical skills in various welding & fabrication processes						
	Specific Learning Objective	Supervisor's Activities	Learning Resources	Specific Learning Objective	Supervisor's Activities	Learning Resources
				8.1 Carryout a project in structural steelwork involving various welding and fabrication	Demonstrate for the students to learn and them to practise. Assess the students.	

				processes.		

Assessment: Exam 40%, Practical 40%, Course Work 10%, Test 10%

LABORATORIES, WORKSHOPS, STUDIO AND DRAWING ROOMS REQUIRED

Programme	Laboratory	Workshop	Studio/Drawing Room and Others
NID Welding & Fabrication	<ol style="list-style-type: none"> 1. Metallography 2. Material Testing 3. Metrology 4. Strength of Materials 	<ol style="list-style-type: none"> 1. Machine Shop 2. Fitting Shop 3. Welding/Fabrication/Heat treatment/Forge 	<ol style="list-style-type: none"> 1. Drawing Room 2. Computer Studio 3. Photocopying Room

LIST OF EQUIPMENT/TOOLS

(A) WORKSHOPS/STUDIOS

(1) FITTING/MACHINE SHOP

FITTING

1.	Work benches for 30 Students	10
2.	Bench Vices	20
3.	Pillar Drilling Machine	1
4.	Marking out Table	1
5.	Surface plate	2
6.	Bench Drilling Machine	1
7.	Radial Drilling Machine	1
8.	Pedestal Grinding Machine	1
9.	Power Hacksaw	1
10.	Arbor Press	1
11.	Flat Rough File (300mm)	20
12.	Round (Rough & Smooth) File (300mm)	20each
13.	Square Rough File (300mm)	20
14.	Flat Smooth File (250mm)	20
15.	Half-Round Rough File (150mm)	20
16.	Triangular Rough File (150mm)	20
17.	Half-Round Smooth File (250mm)	20

18.	Triangular Smooth File (150mm)	20	
19.	Try Square	20	
20.	Dividers	20	
21.	Wallet of Wording File	10 sets	
22.	Scribers	10	
23.	Vee Block and Clamp	2	
24.	Scribing Block	2	
25.	Stock and Dies (set) metric	3 sets	
26.	Tap and Wrenches set (metric)	3 sets	
27.	Hacksaw Frame	20	
28.	Centre Punches	20	
29.	Scrapers (set)	10 sets	
30.	Hand Drill	2	
31.	Centre Drills (sets)	10 sets	
32.	Tap Extractor (sets)	2 sets	
33.	Screw Extractors (set)	2 sets	
34.	Screw Gauges (assorted)	5 each	
35.	Hammers (assorted weights)	10 each	
36.	Hydraulic Press	1	
37.	Hand Shear/curved strip and straight strips		5
38.	Letter Stamps	2	
39.	Number Stamps	2	

40.	Vernier Height Gauge	2
41.	Electric and Grinder/Sander	2
42.	Electric Hand Drill	2
43.	Dial Indicators & Stand	2

MACHINE SHOP

1.	Milling Machine	
2.	Shaping Machine	1
3.	Planing Machine	1
4.	Guillotines	
	(i) Gabro-type Box/Pan folder BF 620	1
	(ii) Gabro-type Combined Apparture Guillotine	1
5.	Turret or Capstan Lathe	1
6.	Harrison Trainer 250 – dual purpose CNC/ Manual lathe, Complete with Bench Speed Head Stock	1
7.	Bench Lathe (Melcer -3 model)	1
8.	Riveting Machine	1
9.	Pliers (Engineer’s Combination, multi-groove, vice grip, diagonal cutting, Long nose, slide cutting)	6 each
10	Screw Driver	
	(i) Standard Tip (6 x 100mm)	5
	(ii) Standard Tip (4 x 400mm)	5

	(iii) Offset Straight Up 1 & 2	5 each
	(iv) Straight Tip Spring Chip (12 x 150mm)	5
	(v) Philips (2 – 6mm)	5 each
11.	Spanners	
	(i) BSW Spanner & Wrench	5 sets
	(ii) Open-Ended Spanner sets British Whitworth set (metric)	3 sets
	(iii) Ring Spanner Sets	3 sets
	(iv) Miniature Spanner Set	3 sets
	(v) Socket Spanner Set (12mm drive)	3 each
12.	Micrometers (three sizes with capacities 0 – 25mm – 50mm 50 – 75mm) outside & inside sets	3 each
13.	Milling Machines	1No.
14.	Surface Grinding Machines	1No.

(2) WELDING/FABRICATION/ HEAT TREATMENT WORKSHOP

(i) Welding Section

1.	Spot Welding Machine	5
2.	TIG Welding Machine	5
3.	Manual Arc Welding Machine	5
4.	MIG/MAG Welding Machine	5
5.	Welding Machine Generator	5
6.	Welding Machine Transformer	5
7.	Oxygen Cylinders	5

8.	Acetylene Cylinders	5
9.	Argon Cylinders	5
10.	CO ₂	5
11.	Oxy-Acetylene Welding Manifold	10
12.	Weld Joint Teaching Aids (Diagrams)	3
13.	Apron	30
14.	Hand Gloves	30 pairs
15.	Welding Head Shield	30
16.	Electrode Oven	1
17.	Work Benches for each Welding Machine	20
18.	Portable Profile Gas Cutting Machine	1
19.	Soldering Iron	10
20.	Oxy-Acetylene Regulators	5 each
21.	Booth Screen	20
22.	Gas Welding Goggles	20
23.	Electrode Holder	30
24.	Welding Chipping Hammer	15
25.	Wire Brush (bench type)	10
26.	Gas Cylinder Trolley	2
27.	Spark Lighter	56
28.	Brazing Rods	10kg
29.	Soldering Flux	10 tins
30.	Bending Machine for Testing Welds	1
31.	Flash Welding Machine	1
32.	Submerge-Arc Welding Machine	1
33.	Plastic Welding Machine	1
34.	Profile Heavy Duty Cutter Gas	1
35.	Gas Welding Blow Pipe	5
36.	Gas Welding Cutting Blow Pipe	5
37.	Oxy-Acetylene Welding Hoses	30 metres each
38.	MAG (CO ₂) Regulator	5
39.	Welding Face Shield	20
40.	Argon Regulator	5

41.	Leggings	10 pairs
42.	Safety Charts	Assorted

(ii) Fabrication Section

1.	Hand Drilling Machine	2
2.	Jig Saw Cutting Machine	2
3.	Vernier Calliper	4
4.	Calibrated Try Square	5
5.	Callipers	4
6.	Sup Shear	2
7.	Tool Boxes containing Flat Spanners and Socket Spanners	2
8.	Panel Beating Tool Set	4 sets
9.	Number Stamp	1 sets
10.	Giant Ring Spanners	4
11.	Long Nose Pliers	5
12.	Shifting Pliers	1
13.	Allen Keys	10
14.	Sledge Hammer	2
15.	Giant Socket Spanners	4
16.	Bench Grinding Machine	5
17.	Anvil and Stand	5
18.	Clamp	5
19.	Steel Rule	4
20.	Twist Drill Set	10
21.	Power Saw Cutting Machine	4 sets
22.	Pipe and Flange Cutting Machine	2
23.	Band Saw Machine	2
24.	Hand Shearing Machine	1
25.	Guillotine Cutting Machine	1
26.	Manual Drilling Machine	1
27.	Air Compressor	1

28.	Break Press Machine	1
29.	Screw Press	2
30.	Pipe Bending Machine	2
31.	Table Tool Grinder	1
32.	Work Bench (Wood)	10
33.	Work Bench (Metal)	10
34.	Vices	30
35.	Marking off Table	1
36.	Snap Rod Cutter	1
37.	Auto Body Fender Set	2
38.	Erichsen Cupping Test Machine	1

(iii) Heat Treatment

1.	Medium Size Muffle Furnace (0 – 1200 °C)	1
2.	Metal Tong	5
3.	Thermocouples (assorted)	1 each
4.	Pyrometer (optical type)	1
5.	Quenching Bath (oil, water, salt solution) Thermostatically controlled.	1 each
6.	Salt Bath Furnace (oil fired)	1
7.	Cooling Curve Determination Set	1
8.	Jominy End-Quench Test Apparatus	1

(iv) Studio/Drawing Room

1.	Drawing Table complete with Drafting Machine	2
2.	Drawing Board with Tee Squares	30
3.	Adjustable Set Squares	2
4.	Desk Sharpener	4

5.	Scale Rule (triangular and flat)	2 each
6.	Black Board Rule	2
7.	Black Board Set Square (45 ⁰ , 60 ⁰)	2 each
8.	Black Board Protractor	2
9.	Black Board Compasses	2
10.	French Curve	2
11.	Letter and Number Stencils 2mm, 4mm, 5mm, 7mm, 8mm and 10mm	2 each

(v) Computer Studio

* Not less than (30 nos.) computer sets should be available for software practice.

(B) LABORATORIES

(i) Metallography

1.	Metallurgical Microscope (bench type)	2
2.	Metallurgical Microscope with built-in transformer And rheostat accessories;	1
	(i) Telescope Camera	1
	(ii) Films	20 pkts
	(iii) Development Paper	20 pkts
3.	Grinding and Polishing Rotary Machine, 203mm wheel, 50 – 500rpm.	2
4.	Spare Aluminium Wheel (230mm) for item 3 above	2
5.	Four (4) Stage Roll Hand Grinder with water flow	2
6.	Grinding Paper (Silicon Carbide) with grits 240, 320, 600, 800	3 pkts each.
7.	Metallurgical Sample mounting hydraulic press with Accessories and thermostatically controlled heater	1
8.	Paper Disc, 203mm with PSA adhesive back	10
9.	Polishing Cloths (micro cloths)	2 pkts

10.	Phenolic Powder Dispenser	1 tin
11.	Mould Release (Silicone)	1
12.	Polishing Powder A1-203 (0.3 micron)	2 tins
	" " " (0.5 micron)	2 tins
	" " " (1.0 micron)	2 tins
13.	Polishing Suspension CO_2O_3 (1.0 micron)	1 tin
14.	Desiccators Specimen Cabinet	1
15.	Cold/Hot Blower (hand operated)	2
16.	Etching Reagents (Nital, Ferric Chloride, diluted Sulphuric Acid, diluted Hydrochloric Acid)	Assorted
17.	Fume Cup-Board	1

(ii) Material Testing Laboratory

DESTRUCTIVE TESTING

1.	Floor Mounted Universal Tensile/Compressive Testing Machine With accessories, with loading capacity up to 100KN	1
2.	Table Top Tensometer with accessories	1
3.	Impact Testing Machine (Izod, Charpy)	1
4.	Macro-hardness Testing Machine with accessories (Brinell, Vickers and Rockwell).	1 each
5.	Metal cutting-off disc machine	1
6.	Macro-hardness Testing Machine	1

(iii) Metrology Laboratory

1.	Sine Bars	3
2.	Slip Gauges	4
3.	Depth Gauges (1/20, 200 mml)	15
4.	Vernier Callipers	15
5.	Slide Gauges with dial indicators	10

6.	Micrometer Screw Gauge (100mm – 200mm)	10
7.	Universal Dial Gauge Stand	5
8.	Angle Gauges (200 - 300)	5
9.	Steel Measure (500mm length)	5
10.	Spring headed pointed callipers	10
11.	Steel Measuring Tapes (2 metres)	5
12.	Inside and Outside Callipers	10
13.	Screw Drivers (set of various types)	4 sets
14.	Vibratory Engraver	2
15.	Horizontal and Vertical Comparator	1
16.	Surface Measuring Instrument (tally surf)	1
17.	Roundness Measuring Instrument (tally round)	1
18.	Flatness Inter Ferro-meter	1
19.	Optical Bevel Protractor	1
20.	Tool Makers Microscope	1
21.	Universal Pitch Measuring Machine	1
22.	Universal Gear Measuring Machine	1

(iv) Strength of Materials Laboratory

1.	Shear Force Apparatus	1
2.	Bending Moment Apparatus	1
3.	Gyroscope Apparatus	1
4.	Polygon of Force Apparatus	1
5.	Young's Modulus Apparatus	1

SAFETY EQUIPMENT FOR EACH WORKSHOP AND LABORATORY

1.	First Aid Box	2 sets
2.	Safety Boots	20 pairs
3.	Leather Apron	30
4.	Leather Hand Gloves	30 pairs
5.	Fire Extinguishers	30

6.	Sand Buckets	30
7.	Safety Charts and Drawings	assorted.

CURRICULUM DESIGN & DRAFT TEAM MEMBERS

S/NO.	NAME	CONTACT ADDRESS, E-MAIL & TEL. NO.
1.	Engr. Dr. Nuru A. Yakubu, <i>oon</i>	Executive Secretary, NBTE, Kaduna & National Coordinator
2.	Dr. M. S. Abubakar	Director of Programmes, NBTE, Kaduna
3.	Mr. B. N. Niriyus	Deputy Director of Programmes, (PHR), NBTE, Kaduna
4.	Engr. J. O. Falade, <i>FNSE</i>	Ag. Deputy Director of Programmes, (Polys), NBTE, Kaduna
5.	Mal. Aliyu Lemu	Assistant Chief Programmes Officer, NBTE, Kaduna. aliyulemuniger2006@yahoo.com
5.	Engr. S. M. Yusuf	Principal Programmes Officer, NBTE, Kaduna.
6.	Engr. J. I. Ukpai, <i>MNSE</i>	Senior Programmes Officer, NBTE, Kaduna. itemukpai@yahoo.com.

LIST OF PARTICIPANTS OF FINAL NATIONAL CRITIQUE WORKSHOP

S/NO.	NAME	ADDRESS
1.	Omo-Aduigho L Godson	Nigerian Institute of Welding, No. 5 Effurun Street, Off Wacco Road, Effurun – Delta State
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3.	Musa Bashar	Musa Bashar, Metal Construction Company, Kaduna
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5.	Taiwo Akinola	Highland College, Ibadan
6.	Adeleke S. Olugesun	Ministry of Education, Office of Special Adviser, TVE, Ministry of Education, Lagos
7.	Engr. BK Mohammad, FNSE	Defence Industrial Corporation, HQ, No. 46 Ahmadu Bello Way, P.M.B. 1315, Kaduna.
8.	Engr. Dr. Nuru A Yakubu, OON	Executive Secretary, NBTE Kaduna
9.	Dr. M S Abubakar	Director of Programmes NBTE, Kaduna
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