HIGHER NATIONAL DIPLOMA (HND)

IN

TRANSPORTATION TECHNOLOGY

CURRICULUM AND COURSE SPECIFICATIONS

GENERAL INFORMATION

Diplomates of this Programme will work in the following Industry

- Transport and logistics industries, Dangote, NPA, NIMASA, Railways,
- Inland waterways,
- Mass transit services
- Ministry of Transport
- Airlines
- Shipping and Maritime Industries
-

Duties Graduates of this Programme are expected to do at the industry

- Manage fleets
- Mange crane operations
- Design and develop ITS systems
- Assist in Transport Technology Research
- Planning and providing the right technology for the industry
- Proffer solutions for critical transport technological problems
- Carry out maintenance operations on auto systems
- Carry out body interior trimming fittings
- Inspect and diagnose problems in auto transport systems

CERTIFICATION AND TITLE OF THE PROGRAMME:
The certificate to be awarded and the programme title shall read:

"NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY"
A transcript showing all the courses taken and grades obtained shall be issued on demand.

2.0 TRANSPORT TECHNOLOGY

3.0GOALS AND OBJECTIVES

The National Diploma Programme in transport technology is aimed at producing technicians with entrepreneurial skills for both the public and private sectors of the economy.

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

- Function as a technologist in transport technology sector;

- Produce good Engineering drawings and schedules using AutoCAD and other relevant software;
- Interpret relevant Engineering drawings;
- Carry out necessary general maintenance procedures in fault detection and rectification of related products;
- Carry out the maintenance of transport technology components**;**
- Observe relevant safety precautions in this practice;
- Carry out relevant material identification and selection
- Manage own enterprises effectively and efficiently;
- Manage transport technology operations;
- Design and develop Intelligent Transportation Systems(ITS);
- Plan and advise on the best technology for the industry;
- Proffer solutions for critical transport technological problems;
- Inspect, diagnose and maintain automotive transport systems;
- Assist in Transport Technology Research; and
- Adopt technical, creative, communication, management and team-working skills to meet the needs of the industry.

4.0 ENTRY REQUIREMENTS

The general entry requirements for the HND programme include:

a. all the requirements for admission into the ND programme in mechanical engineering. ND Civil, Auto-Body technology &Agric Eng. Tech. can be admitted with make-up courses

b. a minimum of lower credit pass (CGPA) of 2.50 and above in the ND examination in Engineering Technology; and

c. a minimum of one year cognate work experience.

In exceptional cases, the ND diplomates with a pass grade (CGPA) 2.0 - 2.49) in the ND examination that had two or more years of cognate work experience may be considered for admission into the HND programme. However, the number of candidates should not be more than 10% of the total student intake in each class.

5.0 CURRICULUM

5.1 The curriculum of the ND programme consists of four main components. These are:

General Studies/Education
Foundation Courses
Professional Courses
Industrial Works Experience (IWE)

*****6.0 CURRICULUM STRUCTURE**

The structure of the ND programme consists of four semesters of classroom, laboratory and workshop activities in the centre and Industrial Work Experience.

Each semester shall be of 17 weeks duration made up as follows:15 contact weeks of teaching, i.e. lecture recitation and practical exercises, etc. and 2 weeks for tests, quizzes, examinations and registration.

7.0 CONDITIONS FOR THE AWARD OF THE ND

Institutions offering accredited programmes will award the National Diploma to candidates who successfully completed the programme after passing prescribed course work, examinations, diploma project and the industrial work experience in pipeline maintenance and related industries. Such candidates should have completed the minimum prescribed credit units.
Diploma Certificate shall be awarded based on the following classifications:

Distinction - CGPA 3.50 - 4.0
Upper Credit - CGPA 3.00 - 3.49
Lower Credit - CGPA 2.50 - 2.99
Pass - CGPA 2.00 - 2.49

8.0 GUIDANCE NOTES FOR TEACHERS TEACHING THE PROGRAMME

8.1 The new curriculum is drawn in course units. This is in keeping with the provisions of the National Policy on Education, which stress the need to introduce the credit units, which will enable a student who so wishes to transfer the units already completed in an institution to another institution of similar standard.

8.2 In designing the units, the principle of the modular system has been adopted; thus making each of the professional modules, when completed self-sufficient and providing the student with technical 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 different institutions and industries, the curriculum content has been written in terms of behavioral objectives, so that it is clear to all, the expected

performance of the student and diplomate of the programme who successfully completed some or all of the courses is clearly defined. 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 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 system.

TABLE OF CONTENT

E	**General Studies and Management Courses**
1	Communication in English I
2	Communication in English III
3	Communication in English IV
4	Literary Appreciation and Oral Composition
5	Technical Report Writing II
6	Entrepreneurship Development
7	Research Methodology

F	**Computer and Electrical Courses**
1	Control systems
2	Fundamentals of auto electric systems
3.	Computer aided design and drafting
4	Computer Programming
5	Electrical Engineering Science

G	**Mechanical Engineering Courses**
1.	Mechanical engineering science
2.	Metrology
3	Safety and Comfort Systems
4.	Automotive Hydraulic and Pneumatics
5	Marine Plant Services & Maintenance

6. Renewable Energy Theory and Application

H Transportation Technology courses

1 Energy and Power in Transportation Systems

2 Energy Systems and the Environment

3 Transportation and the Environment

4 Introduction to Intelligent Transportation System, ITS

5. Transportation Technology Fundamentals I

6. Transport and the Society

7. Transportation Technology Skills I

8. Transportation Technology Fundamentals Ii

9. Transportation Technology Skills II

10. Vehicle Ownership

11. Vehicle Maintenance I

12. Transportation Technology Fundamentals III

13. Transportation Technology Skills III

14. Vehicle Maintenance II

15. Elements of transportation Technology

16 Transport System Management

17 Workshop Management

18. Advanced Workshop technology

I List of Books

J References

K List of Participants

L List of Workshop/Laboratories Equipment

1st SEMESTER

Course Code	Course Title	L	T	P	CU	CH
GNS 301	Communication in English 1	2	0	0	2	2
MTH 311	Advanced Algebra	1	1	0	2	2
TRT 301	Advanced Workshop technology	1	0	2	3	3
ICT 101	Computer Programming	0	0	2	2	2
TRT 302	Energy and Power in Transportation Systems	1	0	2	3	3
TRT 303	Transportation Technology Fundamentals I	3	0	0	3	3
COM 201	Computer Aided Design and Drafting (AutoCAD)	2	0	0	2	2
EEC 115	Electrical Engineering Science	2	0	0	2	2
TRT 325	Elements of Transportation Technology	2	0	0	2	2
MEC 111	Mechanical Engineering Science	1	0	2	3	3
MCE 108	Fundamental Of Auto-Electric Systems	1	0	2	3	3
MCE 208	Control System	1	0	2	3	3
	TOTAL	**17**	**1**	**12**	**30**	**30**

2nd SEMESTER

Course Code	Course Title	L	T	P	CU	CH
GNS 302	Communication in English III	1	1	0	2	2
MTH 302	Advanced Calculus	1	1	0	2	2
TRT307	Energy Systems and the Environment	2	0	0	2	2
TRT 304	Safety and Comfort Systems	3	0	0	3	3
TRT 305	Transportation and the Environment	2	0	0	2	2
TRT 306	Introduction to Intelligent Transportation System, ITS	2	0	0	2	2
TRT 308	Transportation and the Society	3	0	0	3	3
MEC 317	Technical Report Writing II	1	1	0	2	2
TRT 312	Transportation Technology Skills I	2	0	0	2	2
MAR 202	Marine Plant Services & Maintenance	2	0	3	5	5
	TOTAL	**19**	**3**	**3**	**25**	**25**

3rd SEMESTER

Course Code	Course Title	L	T	P	CU	CH
MTH 311	Advanced Algebra	1	1	0	2	2
TRT 309	Transportation Technology Fundamentals II	2	0	0	2	2
TRT 310	Transportation Technology Skills II	0	0	3	3	3
TRT 311	Vehicle Ownership	2	0	0	2	2
TRT 322	Vehicle Maintenance I	1	0	3	4	4
STA 403	Research Methodology	1	0	0	1	1
MCE 112	Automotive Hydraulic and Pneumatics	2	0	2	4	4
GNS 401	Communication in English IV	2	0	0	2	2
RET 302	Renewable Energy Theory and Application	2	0	1	3	3
TRT 328	Transport System Management	2	0	0	2	2
TRT 329	Workshop Management	1	0	0	1	1

	TOTAL	**16**	**1**	**9**	**26**	**26**

4th SEMESTER

Course Code	**Course Title**	**L**	**T**	**P**	**CU**	**CH**
MTH 413	Statistical Methods in Engineering	1	1	0	2	2
MEM 411	Metrology	1	0	2	3	3
TRT 313	Engine Management System	1	0	2	3	3
TRT 314	Transportation Technology Skills III	1	0	2	3	3
TRT 315	Vehicle Maintenance II	2	0	2	4	4
EED 413	Entrepreneurship Development	2	0	2	4	4
TRT 327	Professional Ethics	2	0	0	2	2
GNS 402	Literary Appreciation and Oral Composition	2	0	0	2	2
TRT 316	Project	0	0	6	6	6
	TOTAL	**12**	**1**	**16**	**29**	**29**

MATHEMATICAL COURSES

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY

Course: **ADVANCED ALGEBRA**

Course Code: MTH 311

Contact Hours: 2 Hour/Week (2-0-0)

Goal: This course is designed to develop the student's skill in advanced algebra Techniques.

GENERAL OBJECTIVES:

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

1.0 Understand hyperbolic, exponential and logarithmic functions.

2.0 Understand power, Maclaurin and Taylor series with application to logarithmic and hyperbolic functions.

3.0 Understand the principle of mathematical induction.

4.0 Understand the principles of matrices as applied to engineering problems.

5.0 Understand the principle of vector Algebra.

6.0 Understand the concept and application of complex numbers.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
Course: ADVANCED ALGEBRA		**Course Code:** MTH 311		**Contact Hours:** 2 hour/week		
Course Specification: Theoretical Content: 2 hr				**Practical Content :**0 hr		
GOAL: This course is designed to develop the student's skill in advanced algebra Techniques.						
	Theoretical Content			Practical Content		
	General Objective 1.0: Understand hyperbolic, exponential and logarithmic functions.					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-3	1.1 Define hyperbolic sine and cosine functions in terms of exponential functions 1.2 Draw the hyperbolic graphs for sine, cosine, tangent 1.3 Transform hyperbolic to trigonometrical functions, and vice – versa 1.4 Evaluate universal trigonometric logarithmic functions 1.5 Review logarithmic functions 1.6 Solve problems involving 1.4 above e.g evaluate $\tan^{-1}$□□□□□□ $\tan^{-1}$□□□□□□	▪ Illustrate with good examples and make notes where necessary ▪ Define hyperbolic sine and cosine functions in terms of exponential functions and draw the hyperbolic graphs for sine, cosine, tangent ▪ Transform hyperbolic to trigonometrical functions, and vice-versa ▪ Evaluate universal trigonometrical functions and solve problems relating to it. E.g $\tan^{-1}$□□□□□□ $\tan^{-1}$□□□□□□ ▪ Assess the students	Recommended textbook, marker board, marker, lecture notes etc.	-	-	-

	General Objective 2.0: Understand power, Maclaurin and Taylor series with application to logarithmic and hyperbolic functions.					
4-6	2.1 State the power series of the form (1+n) 2.2 Evaluate power series in 2.1 above 2.3 Test for the convergence/divergence of the series in 2.2 above 2.4 Apply Taylor's formula 2.5 Derive Macclaurin series from Taylor's formula 2.6 Expand functions of the form cosx, sinx tanhx, e^x Evaluate functions like sin 31^o e^x Text for the convergency/divergency of the series from 2.3 to 2.6 above 2.7 Test for absolute convergency of the series from 2.3 to 2.6 above 2.8 State the L' Hospital rule 2.9 Apply L' Hospital's rule to solve the problems in determinants 2.10 Apply L' Hospital's rule to trigonometric and logarithmic series.	▪ State the power series of the form (1+n) and also evaluate it. ▪ Test for the convergence/divergence of the series ▪ Apply Taylor's formula and derive Macclaurin series from Taylor's formula ▪ Expand functions of the form cosx, sinx, tanhx, e^x and evaluate functions like sin 31^o e^x ▪ Test for absolute convergency of the series evaluate above ▪ State the L' Hospital's rule and apply it to solve problems in determinants, trigonometric and logarithmic series ▪ Assess the stud	Marker, blackboard, Lecture note	-	-	-
	General Objective 3.0: Understand the principle of mathematical induction.					
7-8	3.1 Establish the truth theorem for specific value 3.2 Explain for some fixed integer, n, the truth theorem 3.3 Explain the truth theorem for an integral value (n+1) 3.4 Explain the application of	▪ Establish the truth theorem for specific value, and explain for some fixed integer n, the truth theorem ▪ Explain the truth theorem for an integral value (n+1) ▪ Explain the application of	Marker, blackboard, Lecture note	-	-	-

	mathematical induction on Arithmetic progression $\sum^{n}_{r}$ 3.5 Geometric progression $\sum^{n}_{r2}$	mathematical induction on Arithmetic progression or ▪ Geometric progression $\sum^{n}_{r2}$ ▪ Assess the students				
	General Objective 4.0: Understand the principles of matrices as applied to engineering problems					
9-11	4.1 Define types of matrices, null square, rectangular row 4.2 From matrices from sets of linear equations 4.3 Perform the Arithmetic operations in matrices. Addition, subtraction, etc. 4.4 Obtain the transpose, adjunct, co-factors and the inverse of a matrix 4.5 Describe the use of matrix method to linear simultaneous equation 4.6 Define the Eigen-vector and Eigen-value for a set of matrices 4.7 Perform the partitioning method for very large matrices 4.8 Apply matrices to engineering problems	▪ Define types of matrices - null, square, rectangular, row and form matrices from sets of linear equations ▪ Perform Arithmetic operations in matrices for example: if A = [1 2 3] [0 1 4] B = [2 3 0] [1 2 5] Find (i) A + B, (ii) A - B ▪ Use good examples to illustrate the transpose, adjunct co-factors and inverse of a matrix ▪ Assess the students ▪ Explain how to use matrix to solve linear simultaneous equations. And ask the students to solve some examples ▪ Explain eigenvector and Eigen value for set of matrices	Marker, blackboard, Lecture note	-	-	-

		▪ Assess the students ▪ Compute AB, given A = [2 1 0] [3 2 0] [1 0 1] and B =[1 1 1 0] [2 1 1 0] [2 3 1 2] ▪ By partitioning. ▪ Illustrate how matrices are applied in engineering problem. ▪ Assess the students				
	General Objective 5.0: Understand the principle of vector Algebra.					
12-13	5.1 Add, subtract and multiply vectors 5.2 State the divergence theorem 5.3 Explain surface integrals as volume integrals 5.4 Stocke's theorem 5.5 Evaluate certain integrals using stocke's 5.6 Explain vector integration, and vector differential gradient and divergence	▪ Explain to the students with good examples and make notes where necessary ▪ carry out the addition, subtraction and multiplication of vectors ▪ State divergence and stocke's theorems ▪ Evaluate certain integrals using stocke's formula ▪ Explain surface integrals as volume integrals ▪ Explain vector integration, and vector differential gradient and divergence	Recommended textbook, markerboard, lecture notes	-	-	-

		and apply the analysis to engineering problems. ▪ Assess the students.				
	General Objective 6.0: Understand the concept and application of complex numbers.					
14-15	6.1 Explain complex number 6.2 Explain rectangular and polar forms of complex number 6.3 Explain the addition and subtraction of complex numbers 6.4 Explain the multiplication and division of complex numbers 6.5 Compute modules and argument of complex numbers e.g → e = 3+4í Find Z →/e/ 6.6 Define a complex number using Argand's diagram 6.7 Add and subtract two samples number using argand diagram 6.8 State De Moiver's theorem for an integer (positive and negative) 6.9 Apply De Moiver's theorem to A.C theory 6.10 Solve equations involving two more complex numbers e.g solve the following equation for the real numbers x and y: (3 + 4í)2 – 2 (n + íy) = n + íy 6.11 Explain rationalization of complex numbers	▪ Explain to the students with good examples and make notes where necessary ▪ Perform the addition, subtraction, multiplication and division of complex numbers ▪ Compute modules and argument of complex numbers e.g Z = 3 + 4í Find /Z/, Arg.Z ▪ Define complex number using argands's diagram ▪ Assess the students	Recommended textbooks Whiteboard Lecture Note	-	-	-

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

PROGRAMME: **HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**

Course: **ADVANCED CALCULUS**

Course Code: MTH 312

Contact Hours: 2 Hour/Week (2-0-0)

Goal: This course is designed to develop the student's skill in advanced calculus Techniques.

GENERAL OBJECTIVES:

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

1.0 Understand Lap lace transform

2.0 Understand Fourier series and apply it to solve engineering problems

3.0 Understand the methods of solving second – order differential equations

4.0 Understand methods of solving simultaneous linear differential equations

5.0 Understand the methods of solving partial differential equations and their uses

6.0 Understand the principles of functions of several variables and their uses

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
Course: ADVANCED CALCULUS		**Course Code:** MTH 312		**Contact Hours:** 2 hour/week		
Course Specification: Theoretical Content: 2 hr				**Practical Content :**0 hr		
GOAL: This course is designed to develop the student's skill in advanced calculus Techniques.						
	Theoretical Content			Practical Content		
	General Objective 1.0: Understand Lap lace transform					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-4	1.1 Define Laplace transform 1.2 Obtain Laplace transform of simple functions 1.3 Define the inverse Laplace transform 1.4 Obtain the inverse Laplace transform of simple functions 1.5 Evaluate some partial fractions with: a. linear denominator b. quadratic 1.6 Express the derivative in La place transform 1.7 Express unit step, impulse Driac delta and ramp functions in lap lace transform 1.8 Apply Laplace transform to differential equation e.g solve by Laplace transform the boundary – value problem:	▪ Illustrate with good examples and make notes where necessary ▪ Define Laplace transform and apply in simple functions ▪ Evaluate some partial fractions as indicated in 1.5 and express the derivative in Laplace transform. ▪ Assess the students	Recommended textbook, markerboard, marker, lecture notes, etc	-	-	-

	$\frac{\partial u}{\partial t} = \frac{4\partial^2 u}{\partial x^2}$ $u(O,t) = 0,\ u(3,t) = O$ $u(x, O) = I0 \sin 2x - 6 \sin 4x$ 1.9 Apply Laplace transform to suitable engineering problems e.g use Laplace transform to find the charge and current at anytime in a series circuit having an inductance L, capacitance C, Resistance R, emf E, assume charge and current are zero					
	General Objective 2.0: Understand Fourier series and apply it to solve engineering problems					
5-6	2.1 Define Fourier series 2.2 Explain the periodic function 2.3 Explain the non-periodic function 2.4 Identify even and odd functions 2.5 Explain even and odd functions using graphical representation 2.6 Explain the characteristics of even and odd functions 2.7 Derive the Fourier coefficients in both polar and rectangular forms 2.8 Expand simple functions in Fourier series e.g a. simple linear algebraic functions b. trigonometric and logarithmic functions 2.9 Derive the Fourier series for a trigonometric function using the half range approach	▪ Illustrate with good examples -and make notes where necessary. ▪ Define Fourier series, explain the periodic and non Mechanical periodic functions, identify even and odd functions and explain them using graphical representation ▪ Ask the students to derive the Fourier coefficients in both the polar and rectangular forms ▪ Expand simple functions in Fourier series as indicated in 2.8 ▪ Derive Fourier series for	Recommended textbooks, markerboard, marker, Lecture note, etc.	-	-	-

	2.10 Expand functions with arbitrary period 2.11 State the Euler's formula 2.12 Establish a complex Fourier series 2.13 Evaluate the integration of Fourier series 2.14 Apply Fourier series to suitable engineering problems	trigonometric functions using the half range approach, and expand functions with arbitrary period ▪ State Euler's formula and establish a complex Fourier series ▪ Evaluate the integration of Fourier series and apply Fourier series to solve engineering problems ▪ Assess the students.				
	General Objective 3.0: Understand the methods of solving second – order differential equations					
7-8	3.1 Identify a homogeneous linear equation of the second order 3.2 Establish the second order differential equation with constant coefficients viz: $\underline{a(d^2y)} + b\underline{(dy)} + Cy = O$ $dx^2 \qquad dx$ 3.3 Find the real and distinct, equal and complex roots for 3.2 above 3.4 Solve the fundamental system of general solution, given initial values 3.5 State Caudiy's equation 3.6 Explain the existence and uniqueness of solutions to 2nd Order differential equations problems 3.7 Explain the homogeneous linear equations of higher order constant	▪ Illustrate with good examples and make notes where necessary ▪ Ask the students to: establish 2nd Order D.E with constant coefficients viz: $\underline{a(d^2y)} + b\underline{(dy)} + Cy = O$ $dx^2 \qquad dx$ and find the real and distinct, equal and complex roots for the equation above. Solve the fundamental system of general solution, given initial values and also to state	Recommended textbooks, markerboard, marker, Lecture note, etc.	-	-	-

	coefficients 3.8 Solve non-homogeneous differential equations 3.9 Solve simple simultaneous differential equations	Caudiy's equation. ▪ Explain the existence and uniqueness of solutions to 2nd Order differential equations problems and homogeneous linear equations of higher order constant coefficients ▪ Solve many problems on non-homogeneous differential equations, and simple simultaneous differential equations ▪ Assess the students				
	General Objective 4.0: Understand methods of solving simultaneous linear differential equations					
9-10	4.1 Explain linear differential equation 4.2 Identify special cases of solving first – order differential equations 4.3 Apply the method of exact equations, separable variable to solve differential equation problems 4.4 Apply knowledge of linear differential equation to suitable engineering problem	▪ Illustrate with good examples and make notes where necessary ▪ Explain linear differential equation and identify special cases of solving first-order differential equations ▪ Apply the equation, separable variable to solve differential equation problems and apply it in suitable engineering problems ▪ Assess the students	Recommended textbooks, markerboard, marker, Lecture note, etc.	-	-	-
	General Objective 5.0: Understand the methods of solving partial differential equations and their uses					
11-12	5.1 State partial differential equation of order 2	▪ Illustrate with good examples and make notes	Recommende	-	-	-

	5.2 Solve partial differential equation using "variable separable" 5.3 Apply D' Alembert's solution of the wave equation to partial differential equation problems 5.4 Apply the Lap lacian concept in polar coordinates to partial differential equation problems	where necessary ▪ State 2nd – order partial differential equation and solve many problems on it using "variable separable" method ▪ Apply D'Alembert's solution of the wave equation and Lap lacian concept in polar coordinates to partial differential equation problems ▪ Assess the students	d textbooks, markerboard, marker, Lecture note, etc.			
	General Objective 6.0: Understand the principles of functions of several variables and their uses					
12-15	6.1 Explain limits and continuity of given functions 6.2 Explain mean-value theorem using total differentials 6.3 State Taylor's formula for functions of several variables 6.4 Derive maxima and minima of functions of several variables including possible saddle points 6.5 Establish the constrained maxima functions of several variables 6.6 Define a line integral in a plane 6.7 Explain the path of integral 6.8 Evaluate line integral problems 6.9 Define the green's theorem in a plane 6.10 Apply green's theorem to solve line integral problems 6.11 Apply double integral to line integrals 6.12 Apply change of variables in triple	▪ Illustrate with good examples and make notes where necessary ▪ Explain limits, continuity of given functions, and mean value theorem using total differentials. ▪ State Taylor's formula, derive maxima and minima of functions of several variables including possible saddle points ▪ Establish the constrained maxima functions of several variables, define a line integral in a plane and explain the path of integral ▪ Evaluate line integral problems	Recommended textbooks, markerboard, marker, Lecture note, etc.	-	-	-

	integrals 6.13 Evaluate the differentiation under the integral sign 6.14 State stoke formula 6.15 Apply stoke formula to line integrals in space 6.16 Apply stoke's formula to suitable engineering problems	▪ Define green's theorem in a plane and apply it to solve line integral problems ▪ Apply double integral to line integral and change of variable in triple integrals ▪ Evaluate differentiation under the integral sign, state stokes formula and apply it to line integrals in space ▪ Explain how stoke's formula is applied to solve engineering problems ▪ Assess the students				

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY

Course: **STATISTICAL METHODS IN ENGINEERING**

Course Code: MTH 413

Contact Hours: 2 Hour/Week (2-0-0)

Goal: This course is designed to develop the student's skill in statistical methods in engineering.

GENERAL OBJECTIVES:

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

1.0 Understand the basic concept of probability distributions and same in solving engineering problems.

2.0 Understand the principle of reliability.

3.0 Understand Basic statistical experimental designs.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
Course: STATISTICAL METHODS IN ENGINEERING		**Course Code:** MTH 413		**Contact Hours:** 2 hour/week		
Course Specification: Theoretical Content: 2 hr				**Practical Content :**0 hr		
GOAL: This course is designed to develop the student's skill in statistical methods in engineering.						
	Theoretical Content			Practical Content		
	General Objective 1.0: Understand the basic concept of probability distributions and same in solving engineering problems.					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-3	1.1 Define a Binomial distribution 1.2 Explain the characteristics of Binomial distribution 1.3 Apply Binomial distribution to samples with replacement 1.4 Apply Binomial distribution to solve engineering problems 1.5 Define the Normal Distribution 1.6 Explain the characteristics of normal distribution 1.7 Describe normal distribution curve and the empirical rule.	▪ Illustrate with good examples and make notes where necessary ▪ Ask the students to: i. Define Binomial distribution, explain its characteristics and apply it to samples with replacement, and to solve engineering problems. ii. Define normal distribution, explain its characteristics and describe normal distribution curve and the empirical rule ▪ Assess the students	Recommended textbooks, marker, board, lecturer notes etc	-	-	-

4-7	1.8 Calculate probability given the mean and the standard deviation 1.9 Calculate the deviation Z given the mean, standard deviation, and a particular observation 1.10 Calculate the area under the curve at different points from either side of the mean 1.11 Apply normal distribution curve to simple engineering problems 1.12 Define Poisson's distribution 1.13 Explain the characteristics of Poisson distribution 1.14 Explain the quality control techniques in production process 1.15 Explain acceptance sampling as applied to mass production 1.16 Test for equality of means of given population using t-test 1.17 Test for equality of variances using the F-test 1.18 Apply the chi-square test in statistical quality control	▪ Ask the students to: i. Calculate probability given the mean and standard deviation ii. Calculate the deviation Z given the mean, standard deviation, and a particular observation iii. Calculate the area under the curve at different points from either side of the mean and also apply normal distribution curve to simple engineering problems ▪ Assess the students ▪ Ask the students to: i. Define Poisson distribution, explain it characteristics, and explain the quality control techniques in production process ii. Explain acceptance sampling as applied to mass production iii. Test for equality of means of given population and equality of variances using t-test and f-test respectively iv. Apply the chi-square test in statistical	Recommended textbooks, markerboard, marker lecturer notes etc	-	-	

		quality control ▪ Assess the students				
	General Objective 2.0: Understand the principle of reliability.					
8-11	2.1 Distinguish between validity and reliability 2.2 List types of reliability testing 2.3 State the procedures for determining test-retest reliability 2.4 Apply test – retest reliability to samples 2.5 State the procedures for determining split half reliability 2.6 Determine the reliability coefficient 2.7 Determine the acceptance level of reliability 2.8 Determine the standard error of measurement $SE_M = \frac{SD}{\sqrt{(1-r)}} \quad \frac{SD}{\sqrt{(1-r)}}$ where SD = standard deviation r = error SE_M = standard error	i. Distinguish between validity and reliability and list types of reliability testing ii. State the procedures for determining test-retest reliability and apply it to samples iii. State the procedures for determining split half reliability, determine the reliability coefficient and acceptance level of reliability ▪ Assess the students i. Determine the standard error of measurement, using the following expression $SE_M = \frac{SD}{\sqrt{(1-r)}} \quad \frac{SD}{\sqrt{(1-r)}}$ where SD = standard deviation r = error SE_M = standard error ▪ Assess the students	Recommended textbooks, markerboard, marker lecturer notes etc	-	-	-

	General Objective 3.0: Understand Basic statistical experimental designs.					
12-15	3.1 Describe various experimental designs e.g complete randomized block design, randomized complete block design, split squares, Graeco Latin squares 3.2 List examples of when any of 3.1 above can be used 3.3 Enumerate the advantages and disadvantages of using the various designs in 3.1 above	i. Describe various experimental designs as indicated in 3.1 and list examples of when any of the designs can be used ii. Enumerate the advantages and disadvantages of using the various designs indicated in 3.1 above ▪ Assess the students	Recommended textbooks, markerboard, marker lecturer notes etc			

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

GENERAL STUDIES COURSES

COMMUNICATION IN ENGLISH I

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: GNS 301**		**Contact Hours: 2HRS**
	Subject/Course: COMMUNICATION IN ENGLISH I			**Theoretical: hours/week**
	Year: 3 Semester: 1	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Know how to construct good sentences
2. Know how to reason apply the basic principles of logic.
3. Know how to write different types of essays.
4. Appreciate Literature in English

	Course: COMMUNICATION IN ENGLISH I	**Course Code: GNS 301**		**Contact Hours: 2**
				Theoretical: hours/week
	Year: 3 Semester:1	*Pre-requisite:*		*Practical: hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: **HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**

COURSE: COMMUNICATION IN ENGLISH I

COURSE CODE: GNS 301

PREREQUISITE: GNS 202

CONTACT HOURS: 2 HOURS/WEEK (2-0-0)

GOALS: This course is intended to further improve the student's level of proficiency and competence in language use. It is designed to increase the student's ability to master and manipulate the various language skills of a higher level.

GENRAL OBJECTIVES:

On completion of the course the student should:

1.0 Know how to construct good sentences.

2.0 Know how to reason apply the basic principles of logic.

3.0 Know how to write different types of essays.

4.0 Appreciate literature in English.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
COURSE: COMMUNICATION IN ENGLISH I			**COURSE CODE:** GNS 301		**CONTACT HOURS:2 hrs**	
GOAL: This course is intended to further improve the student's level of proficiency and competence in language use. It is designed to increase the student's ability to master and manipulate the various language skills of a higher level.						
COURSE SPECIFICATION: Theoretical Contents: 2 hrs				**Practical Contents:**.0		
	General Objective: 1.0 **Know how to construct good sentences.**					
WEEK	**Specific Learning Objective** Theory	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
1	**Sentences** 1.1 Explain the different types	Explain the different types of sentences.	Recommended textbooks, e-Books,	-	-	-

	of sentences. 1.2 Explain the parts of a sentence.	Explain the parts of a sentence.	lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
2	1.3 Explain tenses. 1.4 List the various tenses. 1.5 Construct sentences to depict correct use of tenses.	Explain tenses. List the various tenses. Construct sentences to depict correct use of tenses.	-do-	-	-	-
3	1.6 Explain concord. 1.7 Analyze types of concords.	Explain concord. Analyze types of concords.	-do-	-	-	-
4	1.8 Apply the rules of concord in sentence construction.	Apply the rules of concord in sentence construction.	-do-	-	-	-
	General Objectives: 2.0. Know how to reason applying the basic principles of logic.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	
5	Logic: 2.1 Explain the concept of logical thinking. 2.2 Explain the basic principles of logic, viz, form validity and argument.	• Explain the concept of logical thinking. • Explain the basic principles of logic, viz, form validity and argument.	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	-	-	-
6	2.3 Apply the principles of logic to distinguish fact from opinion.	• Apply the principles of logic to distinguish fact from opinion.	-do-	-	-	-
7	2.4 Differentiate between deductive and inductive reasoning.	• Differentiate between deductive and inductive	-do-	-	-	-

		reasoning.				
8	2.5 Apply the principles of logic in deductive and inductive reasoning.	• Apply the principles of logic in deductive and inductive reasoning.	-do-	-	-	
9	2.6 Explain the premise as a step towards the conclusion.	Explain the premise as a step towards the conclusion.	-do-	-	-	
	General Objectives: 3.0 Know how to write different types of essays.					
WEEK	**Specific Learning Objective** Theory	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
10	**Essay** 3.1 Explain the different types of essays	Explain the different types of essays	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	-	-	-
11	3.2 Explain the characteristics of each type in 3.1 above. 3.3 Explain the logical orders of presentation, e.g. chronological, spatial, general-to-specific, specific-to-general, alternation, inductive, deductive, etc.	Explain the characteristics of each type in 3.1 above. Explain the logical orders of presentation, e.g. chronological, spatial, general-to-specific, specific-to-general, alternation, inductive, deductive, etc.	-do-	-	-	-
12	3.4 Write an expository essay.	Write an expository essay.	-do-	-	-	-
13	3.4 Write an argumentative Essay.	Write an argumentative Essay.	-do-	-	-	-
	General Objectives: 4.0 Appreciate literature in English.					

WEEK	Specific Learning Objective Theory	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
14	Literature 4.1 Explain the term literature. 4.2 List the genres of literature. 4.3 Explain the terminology of poetry, e.g. rhyme, rhythm, enjambment, etc.	Explain the term literature. List the genres of literature. Explain the terminology of poetry, e.g. rhyme, rhythm, enjambment, etc	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	-	-	-
15	4.4 Analyze a given poem. 4.5 Answer an essay question on poetry.	Analyze a given poem. Answer an essay question on poetry.	-do-	-	-	-

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

PROGRAMME: GENERAL STUDIES

COURSE TITLE: COMMUNCIATION IN ENGLSIH III

CODE: GNS 302

PREREQUISITE: GNS 301

DURATION: 2 HOURS PER WEEK (30 HOURS PER SEMESTER)

SCHEDULE: 2ND SEMSTER

GOALS: This course is designed to further expose the student to the principles and practice of written communication. It is designed to enable the student continue to master skills in the use of English in the various professions.

GENRAL OBJECTIVES:

On completion of the course the student should:

1.0 Understand the principles and practice of written communication.

2.0 Comprehend more difficult reading materials.

3.0 Know the procedure for writing project reports.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY		
COURSE:COMMUNICATION IN ENGLISH III	**COURSE CODE: GNS 302**	**CONTACT HOURS:2 hrs**
GOAL: This course is designed to further expose the student to the principles and practice of written communication. It is designed to enable the		

student continue to master skills in the use of English in the various professions.						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**.		
	General Objective: 1.0 **Understand the principles and practice of written communication.**					
WEEK	**Specific Learning Objective** Theory	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
1	**Written Communication** 1.1 Explain the principles of letter writing	• Explain the principles of letter writing	• Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	•	•	
2	1.2 Explain the components of a business letter.	• Explain the components of a business letter.	•	•	•	
3	1.3 Differentiate between a memo and a letter.	• Differentiate between a memo and a letter.	•	•	•	
4	1.4 Prepare a portfolio of correspondence using different presentation techniques: appointments, promotions, dismissals, commendations, queries, condolences, congratulations.	• Prepare a portfolio of correspondence using different presentation techniques: appointments, promotions, dismissals, commendations, queries, condolences, congratulations.	• Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.	•	•	

	General Objectives: 2.0. Comprehend more difficult reading materials.					
WEEK	**Specific Learning Objective** Theory	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	
5	**Comprehension** 2.1 Reading passages of expository and argumentative writing.	• Reading passages of expository and argumentative writing.				
6	2.2 Trace the logic in the passages in 2.1 above.	• Trace the logic in the passages in 2.1 above.				
7	2.3 Differentiate between facts and opinions.	• Differentiate between facts and opinions.				

8	2.4 Answer questions on what is read.	• Answer questions on what is read.				
	General Objectives: 3.0 Know the procedure for writing project reports.				**General Objectives:**	
WEEK	**Specific Learning Objective** Theory	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
9	**Project Reports** 3.1 Explain the characteristics of a project report, viz, part, format, style. 3.2 Select a suitable topic for a project.	• Explain the characteristics of a project report, viz, part, format, style. • Select a suitable topic for a project.	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			-
10	3.3 Explain methods of gathering data from primary, secondary and tertiary sources.	• Explain methods of gathering data from primary, secondary and tertiary sources.				
11	3.4 Use reference materials for gathering data.	• Use reference materials for gathering data.				
12	3.5 Use appropriate citation and documentation styles, eg. APA, MLA. 3.6 Explain the procedure for writing a project	• Use appropriate citation and documentation styles, e.g. APA, MLA.				

	report.	• Explain the procedure for writing a project report.				
13	3.7 Write an outline of a project report using appropriate numbering, ranking and phrasing.	• Write an outline of a project report using appropriate numbering, ranking and phrasing.	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
14	3.8 Write a project report.	• Write a project report.				
15	3.9 Present project report.	• Present project report.				

ASSESSMET: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

PROGRAMME: **GENERAL STUDIES**

COURSE TITLE: COMMUNICATION IN ENGLISH IV

CODE: **GNS** 401

PREREQUISITE: **GNS 302**

DURATION: 2 HOURS PER WEEK (30 HOURS PER SEMESTER)

CREDIT UNITS: **2.0**

SCHEDULE: **1ST** SEMESTER

GOAL(S): At the end of this course the student is expected to be fully equipped to fit into all establishments requiring extensive use of communication skills for general and specific purposes.

GENERAL OBJECTIVES:

On completion of this course the student should:

1.0 Comprehend the theory and practice of communication.

2.0 Know the concept of organisational communication.

	General Objective: 1.0 Comprehend the theory and practice of communication			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
1	On completion of this course the student should: **Theory and Practice of Communication** 1.1 Define communication	**Theory and Practice of Communication** 1.1 Define communication	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
2	**1.2** Explain communication theory	**1.2** Explain communication theory				
3	1.3 Analyse in detail the communication process	1.3 Analyse in detail the communication process				
4	1.4 Explain the different methods of	1.4 Explain the different				

	communication, e.g. oral, written, non-verbal, etc.	methods of communication, e.g. oral, written, non-verbal, etc.				

	General Objective: 2.0 Know the concept of organisational communication			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
5	**Organisational Communication** 2.1 Explain directions of communication flow, viz., internal(vertical, horizontal, diagonal, quasi vertical) and external	**Organisational Communication** 2.1 Explain directions of communication flow, viz., internal(vertical, horizontal, diagonal, quasi vertical) and external	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
6	**2.2** Differentiate inter-personal and intra-personal communication	**2.2** Differentiate inter-personal and intra-				

		personal communication				
7	2.3 Classify communication variables by content, source, channel, receiver, message, and effect	2.3 Classify communication variables by content, source, channel, receiver, message, and effect				
8	2.4 Analyse critically the barriers to effective communication	2.4 Analyse critically the barriers to effective communication				
9	2.5 Analyse non-verbal communication, viz., kinesics proxemics, paralanguage and chronemics	2.5 Analyse non-verbal communication, viz., kinesics proxemics, paralanguage and chronemics	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
10	2.6 Demonstrate the use of the concepts in 2.5 above in a given hypothetical communication situation	2.6 Demonstrate the use of the concepts in 2.5 above in a given hypothetical communicatio				

		n situation				
11	2.7 Explain the impact of certain variables on communication, e.g. environment, power, status, role	2.7 Explain the impact of certain variables on communication, e.g. environment, power, status, role				
12	2.8 Explain the procedures for communicating in debates, meetings, seminars and conferences	2.8 Explain the procedures for communicating in debates, meetings, seminars and conferences	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
13	2.9 Organise debates, meetings, seminars, interviews and conferences	2.9 Organise debates, meetings, seminars, interviews and conferences				
14	2.10 Explain theories of leadership	2.10 Explain theories of				

	2.11 Explain leadership qualities	leadership 2.11 Explain leadership qualities				
15	2.12 Apply the principles of creative and creative thinking in conflict resolution	2.12 Apply the principles of creative and creative thinking in conflict resolution	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

PROGRAMME: **GENERAL STUDIES**

COURSE TITLE: LITERARY APPRECIATION AND ORAL COMPOSITION

CODE: **GNS** 402

PREREQUISITE: **GNS 401**

DURATION: 2 HOURS PER WEEK (30 HOURS PER SEMESTER)

CREDIT UNITS: **2.0**

SCHEDULE: **2ND** SEMESTER

GOAL(S): This course is designed to impart analytical, evaluative and interpretative writing and speaking techniques to the student. The aim is to encourage creativity.

GENERAL OBJECTIVES:

On completion of this course the student should:

1.0 Appreciate the literary genres as sustained composition.

2.0 Understand the development of the literary essay

3.0 Know how to make oral presentation.

	General Objective: 1.0 Appreciate the literary genres as sustained composition			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
1	On completion of this course the student should: **Literary Genres**	**Literary Genres** 1.1 Explain the salient features	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector,			

	1.1 Explain the salient features of the literary genres	of the literary genres	Screen, Magnetic Board, etc.			
2	1.2 Define literary terms, e.g. point of view, myth, archetype, denouement, protagonist, catharsis, symbolism, style, legend, folk tale, proverb, etc.	**1.2** Define literary terms, e.g. point of view, myth, archetype, denouement, protagonist, catharsis, symbolism, style, legend, folk tale, proverb, etc.				

	General Objective: 2.0 Understand the development of the literary essay			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
3	**Literary Essay** 2.1 Explicate one novel	**Literary Essay** 2.1 Explicate one novel	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.			
4	2.2 Explicate one short story 2.3 Explicate one short poem	2.2 Explicate one short story 2.3 Explicate one short poem				
5	2.4 Write a review of a play or novel	2.4 Write a review of a play or novel				
6	2.5 Criticise a television or radio drama	2.5 Criticise a television or radio drama				
	General Objective: 3.0 Know how to make oral presentation			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers**	**Learning**	**Specific Learning**	**Teachers**	**Learning**

		Activities	**Resources**	**Objective**	**Activities**	**Resources**
7	Oral Presentation 3.1 Explain different types of formal oral composition	Oral Presentation 3 Explain different types of formal oral composition				

8	3.1 State the steps in developing an oral composition a) define the purpose, b) select a topic, c) frame the subject sentence, d) define materials for developing (c) above, e) draw up the outline, f) select the mode of delivery, g) rehearse	3.2 State the steps in developing an oral composition h) define the purpose, i) select a topic, j) frame the subject sentence, k) define materials for developing (c) above, l) draw up the outline, m) select the mode of delivery, n) rehearse	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.				

9	3.3 Explain the influence or purpose on developing the subject	3.4 Explain the influence or purpose on developing the subject					
10	**3.5** Explain delivery techniques	**3.6** Explain delivery techniques					
11	**3.7** Explain the language of the radio	**3.8** Explain the language of the radio					
12	3.9 Prepare a radio broadcast for classroom presentation	3.10 Prepare a radio broadcast for classroom presentation	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen,				

			Magnetic Board, etc.				
13	3.11 Explain the techniques of debating	3.12 Explain the techniques of debating					
14	**3.13** Present a one-hour debate	**3.14** Present a one-hour debate					
15	**3.15** Read to the class a play, a poem, a short story written by the student.	**3.16** Read to the class a play, a poem, a short story written by the student.	Recommended textbooks, e-Books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, etc.				

TECHNICAL REPORT WRITING II

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: MEC 317**		**Contact Hours: 2HRS/WK**
	Subject/Course: TECHNICAL REPORT WRITING II			**Theoretical:1 hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: 1 hours /week*

General Objectives
1. Know the procedure for writing project reports

	Course: TECHNICAL REPORT WRITING II	**Course Code: MEC 317**		**Contact Hours: 2**		
				Theoretical: 1 hours/week		
	Year: 1 Semester:2	*Pre-requisite:*		*Practical: 1 hours /week*		
	Theoretical Content			*Practical Content*		
	General Objective 1: Know the procedure for writing project reports					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-7	1.1 Explain the characteristics of a project report, viz – parts, format, style 1.2 Select a suitable topic for a project report 1.3 Explain methods of gathering data from primary, secondary and tertiary	▪ The teacher to illustrate with good examples and make notes where necessary ▪ Ask the students to explain the characteristics of a	▪ Recommended textbook, markerboard, marker,			

8-15	sources 1.4 Use reference materials for gathering data 1.5 Use appropriate citation and documentation styles, e.g APA, MLA, etc 1.6 Explain the procedure for writing a project report 1.7 Write an outline of a project report using appropriate numbering, ranking and phrasing. 1.8 Write a project report	project, viz – parts, formate, style, and select a suitable topic for a project report ▪ Ask the students to explain methods of gathering data from primary, secondary and tertiary sources and also use reference materials for gathering data ▪ Ask the students to use appropriate citation and documentation styles e.g APA, MLA, etc ▪ Ask the students to explain the procedure for writing a project report and write an outline of a project report using appropriate numbering, ranking and phrasing ▪ Ask the students to write a project report ▪ Assess the students	lecture notes, etc.			

ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Recommended Textbooks & References

PROGRAMME: **HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**

Course: ENTREPRENEURSHIP DEVELOPMENT

Code: EEd 413

Pre-requisite: EEd 126 &EEd 216

Contact Hours: 4 HOURS/WEEK (2-0-2)

Course main Aim/Goal

This course is directed towards developing in the student skills, competencies, understandings and attributes that will equip him to be innovative, and to identify, create, initiate, and successfully manage personal, community, business and work opportunities, including working for himself.

General Objectives:

On completion of the course, the student should:

1. Understand the history and government efforts in promoting entrepreneurship development in Nigeria
2. Understand the role of personal savings and portfolio investment in National Economic Development
3. Understand various life skills needed by an entrepreneur
4. Understand the various sources of information for entrepreneurship development
5. Appreciate the roles of commercial and development banks in small scale industrial development.
6. Know the functions of various support agencies in small and medium scale industrial development.
7. Understand the activities of different industrial associations in relation to entrepreneurship.
8. Know the functional areas of business
9. Understand the need for business planning.
10. Understand the strategies for consolidation and expansion of a business enterprise
11. Understand the need for management and business succession plan

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
Course: ENTREPRENEURSHIP DEVELOPMENT						
Course Code: EED 413				**Contact Hours:** 4HRS/WEEK		
Course Specification:		**Theoretical: 2 hours/week**		**Practical : 2 hours/week**		
		Pre-requisite: EED 126 & EED 216				
General Objective 1: Understand the history and government efforts in promoting entrepreneurship development in Nigeria						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
1-2	1.1 Define an Enterprise and identify different forms of Enterprises 1.2 Classify the different forms of enterprises into: private vs. public Profit vs. non-profit Formal vs. informal Individual vs. community Local vs. foreign Business vs. social Small vs. large Manufacturing vs. service Consumer vs. industrial 1.3 Narrate the history of entrepreneurship development in Nigeria. 1.4 Assess the success and impact of entrepreneurship in Nigeria in comparison with other Countries of the world: Japan, India, China, Malaysia, South Korea, etc.	I. Introduce the terms: Enterprise Entrepreneur Entrepreneurship II. Explain the historical development and role of entrepreneurship in enterprise creation in Nigeria. III. Compare and Contrast, using a relevant film, entrepreneurship in Nigeria with other Countries of the world. IV. List support agencies for SMEs in Nigeria-NEPC, IDCs, BOI, NACRDBetc V. Explain government policy on financing SMEs	Text Books	Identify features of the types of enterprises identified. Identify entrepreneurial traits, characteristics and qualities. Identify successful entrepreneurs in Nigeria. Write a brief comparison of entrepreneurship in Nigeria with either Japan or Korea	Guide students to research into different forms of enterprises. Invite a successful entrepreneur to give a talk on traits for successful entrepreneurship. Guide students to search the web on comparative study of entrepreneurship.	Use of internet and relevant video clips Guest speakers from successful businesses.
General Objective 2: Understand the role of personal savings and portfolio investment in National Economic Development						

Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
3-4	2.1 Define the following; Income, expenditure and savings. 2.2 Explain the role of savings in starting and sustaining businesses. 2.3 List the benefits of interest. 2.4 Explain personal financial planning and management 2.5Explain shopping habits. 2.6 Explain how taxes are paid on income that people earn and how income tax is calculated.	I. Explain savings II. Explain how savings are channeled into productive ventures III. Explain the benefits of interest. IV. Explain the role of budgeting in personal economics V. Describe shopping habits VI. Analyze portfolio investment. I. Explain thrift societies and how they operate II. Explain Tax, and how Personal Income Tax is calculated.	Textbooks, Journals and other publications.	Calculate interest rates. Develop personal budget for one month. Create a spreadsheet for a budget Interpret financial reports Describe other investments such as in real estate or stock trading	Show various methods of computing interest Guide students to develop a personal budget for one month Guide students to create a spreadsheet for a budget Guide students on how to read and interpret financial reports annual reports and accounts of quoted companies/institutions Expose students to real estates and commodity trading as other forms of investment. Visit stock/commodity exchange.	Textbooks, Journals and other publications, computer.
General Objective 3: Understand the life skills needed by an entrepreneur.						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
	3.1 Identify the characteristics of an entrepreneur. 3.2 Define Communication. 3.3 Explain the role of Communication in an enterprise. 3.4 Define teamwork and team spirit. 3.5 Identify the characteristics of teams.	I. Explain the characteristics of an entrepreneur. II. Explain communication, its types, process and role in an enterprise. III. Explain teamwork, team spirit, characteristics of teams, and benefits of team		Analyse a diagram of communication process. Demonstrate skills for teamwork Demonstrate leadership skills. Prepare a daily routine of	Draw a diagram of the communication process. Use the diagram to demonstrate chain of communication Organise students into group. Assign each team responsibilities that will enable them demonstrate	

5	3.6 List benefits of teamwork in an enterprise. 3.7 Define leadership. 3.8 List the qualities and characteristics of good leaders. 3.9 Describe a target. 3.10 Explain how targets are set. 3.11 Explain how a target is achieved. 3.12 Explain discipline and self – discipline. 3.13 State the benefits of Personal discipline in the success of an enterprise.	work. IV. Explain decision making, types and decision making process. V. Explain leadership, types of leaders, leadership styles and qualities of good leadership. VI. Explain targets, how they are set and indications of achievement. VII. Explain the sources and benefits of discipline.		personal activities. Set achievable targets for self.	team work/spirit. Let them select their leaders. Invite a seasoned Administrator/Manager to talk to students on leadership. Guide students to prepare a "to-do" list student should set achievable targets. Explain indicators of Target achievement.	
General Objective 4: Understand the various sources of information for entrepreneurship development						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
6	4.1 Identify nature and type of information required by entrepreneurs. 4.2 Identify the sources of the information required in 4.1 above. 4.3 Identify organizations and agencies involved in the promotion and development of entrepreneurship. 4.4 Explain the role of banks and financial institutions in enterprise promotion and development. 4.5 Describe the contributions	I. Explain nature of information required by entrepreneurs: . marketing . technical . ICT . financial . legal II. Explain sources of the information above: . catalogues . business associations . government publications . banks	Text Books Journals Publications Video Film TV & VCR	Obtain the required information from the net. Classify the information into: . marketing . technical . ICT . financial . legal Develop a resource file containing samples and addresses for each category of information sources Write a report on the visit	Guide students to conduct a web search on information required by entrepreneurs. Ask students to develop a similar file using appropriate software. Take students to seminars workshops trade fairs, Trade exhibitions as sources of entrepreneurship information Guide students to identify clients responsible for providing assistance under each method: . personal contacts:	

	of government agencies in sourcing information. 4.6 Describe methods of obtaining assistance from the above organizations.	. mass media . libraries . consultants . assisting agencies . trade exhibitions/ fairs . Internet/websites. I. Explain the role of the various organizations and agencies involved in the promotion and development of entrepreneurship. II. Explain methods of obtaining assistance: . personal contacts . observation . interviews . direct mail . reading . Web/internet research.		Identify clients responsible for providing assistance under each method.	- entrepreneurs - professionals - customers . observation: -trade exhibition . interviews: - customers - suppliers - competitors - distributors - ex-employees - agents - experts and practitioners . reading: - reports and statistics - media -literature etc. . web and internet - competitors - markets - industry information - government. departments.	
General Objective 5: Appreciate the roles of commercial and development banks in small scale industrial development.						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
7	5.1 Identify financial institutions involved in entrepreneurship development. 5.2 Describe the assistance provided by commercial banks. 5.3 Explain the role of development banks in the promotion and development of small and	I. Explain financial institutions involved in entrepreneurship development. II. Explain the roles of commercial and development banks in the promotion and development of SMEs	Text Books Journals Publications Video Film TV & VCR	Guide students on how to maintain good banking relationship	Invite a bank official to give a talk on role of financial institutions in entrepreneurship.	Internet Textbooks Journals Resource person

	medium enterprises (SMEs) 5.4 Assess government policy on financing SMEs 5.5 Explain the process of opening and operating a healthy Bank Account	III. Analyze government policy on financing SMEs				
General Objective 6: Know the functions of various support agencies in small and medium scale industrial development.						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
8-9	6.1 Identify various support agencies involved in the promotion and development of entrepreneurship in Nigeria. 6.2 Explain the following and their roles in the promotion and development of entrepreneurship: . NEPC . NIPC . NERFUND . NDE . RMRDC . SMEDAN . IDC . TICs . Federal and State Ministries of Commerce/ Industry 6.3 Explain the assistance rendered by research and academic institutions in entrepreneurship development.	I. Explain the role and functions of the various support agencies involved in the promotion and development of entrepreneurship II. Explain the roles of research and academic institutions of higher learning in the development of entrepreneurship	Text Books Journals Publications	Distinguish among the functions of each agency.	Show transparency of the various support agencies involved in entrepreneurship development and promotion Invite officers of identified agencies to explain their operations.	Computer or Overhead Projector Resource Persons
General Objective 7: Understand the activities of different industrial associations in relation to entrepreneurship.						

Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
10-11	7.1 Explain the meanings of the following acronyms: . NASSI . NASME . NACCIMA . MAN . NECA . SMEDAN 7.2 Describe the roles and functions of each of the above in the development and promotion of entrepreneurship	I. Explain the role of the National Association of Small Scale Industrialists (NASSI) in entrepreneurship. II. Describe the role and functions of the National Association of Small and Medium Enterprises (NASME) in entrepreneurship. III. Describe City, State and Bilateral Chambers of Commerce and Industry and their roles in entrepreneurship development. IV. Explain the functions and role the National Association of Chambers of Commerce, Industry, Mines and Agriculture (NACCIMA) in entrepreneurship development. V. Explain the roles and functions of the Manufacturers Association of Nigeria (MAN) in entrepreneurship development. VI. Describe Nigerian Employer's Consultative Association (NECA) and its role in entrepreneurship.	Text books Journals Computer Projector	Carry out an excursion to a trade fair and prepare a report on the visit.	Organize an excursion to recognized trade fair closest to you	Computer Projector Guest speaker Internet search.

General Objective 8: Know the functional areas of business						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
12	8.1. Explain basic management concepts and functions. 8.2 Explain the basic functions of human capital management in a small enterprise. 8.3 Explain the cycle of business growth and need for adequate manpower development at each stage. 8.4. Explain labour relations. 8.5 Describe the finance function in a small enterprise. 8.6 List the books of account necessary for operation of small enterprise. 8.7 Explain financial regulations and taxes affecting small enterprise operation. 8.8 Explain the significance of insurance coverage for a small enterprise 8.9 Explain the importance of marketing mix to the growth and expansion of a small enterprise. 8,.10 Explain the production function in a small	I. Explain basic management concepts and Functions. II. Explain the basic functions of human capital management in a small and growing enterprise: - Defining human resources objectives - Designing dynamic organization structures to support the business growth strategy Planning for HR needs in line with growth . Recruitment and selection procedures for productive staff Training and development of productive staff . Enhancing performance through motivation and participation . Communication with staff to enable growth . Establishing effective work relationships required for	Text Books Journals Publications Video Film TV & VCR	Explain how to carryout manpower, procurement and maintenance planning. Demonstrate how to draw up task/job description and assign to staff. -	Guide student to draw up an organogram. Guide student to draw up manpower and resource need for a 3-year circle.	Computer and accessories, internet and visitations.

	enterprise: . product planning and control . production forms and techniques . factory and facilities layout . Operational bottlenecks in the areas of order intake, procurement, storage and inventory control, distribution, safety and health etc. 8.11 Explain the importance of quality control and production standards. 8.12 Explain the need for maintenance management with special reference to: . routine maintenance . scheduled maintenance . preventive maintenance . spare parts management 8.13 Explain staff training and retraining needs of an enterprise.	growth . Maintaining employee records and administration . HR growth plan. I. Explain the finance function in a small and growing enterprise: Identify sources of business finance and financial needs for a small business. . Defining the finance rowth objectives . Analyzing and interpreting financial statements for growth . Financial planning and control for growth . Capital investment appraisal techniques . Management of working capital . How to safeguard business resources II. Explain financial record keeping and books of account necessary in a small enterprise. III. Explain how to prepare simple formats of prime books of account. IV. Explain financial				

		regulations and taxes affecting operations of small enterprises. V. Explain significance of insurance coverage for small enterprises. VI. Explain them marketing function in a small and growing enterprise. VII. Explain the production function in a small enterprise: . product planning and control . production forms and techniques . factory and facilities layout . Operational bottlenecks in the areas of order intake, procurement, storage and inventory control, distribution, safety and health etc. VIII. Explain the importance of quality control and production standards. IX. Explain the need for maintenance management with special reference to: . routine maintenance . scheduled maintenance . preventive maintenance . spare parts management XII. Explain the need for				

		regular capacity building for staff.				
General Objective 9: Understand the need for business planning.						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
13	9.1 Identify a viable business opportunity based on: . demand . availability of resources . import substitution . export oriented products. 9.2 Explain the different steps in preparing a preliminary project report 9.3 Explain how to formulate a project report. 9.4 Explain how to analyze a project report	I. Explain how to identify viable business opportunities based on : . demand . availability of resources . import substitution . export oriented products. II. Explain the different steps in preparing a preliminary project report. III. Explain how to prepare and analyze a preliminary project report.	Text Books Journals Publications	Analyze a sample project report with emphasis on technical, operational, economic viability, methodology, cost-benefit (CBA) analysis on equipment development cost, running cost etc	Guide students to analyze a sample project report Guide students to prepare a preliminary project report. Guide students to complete the business plan of their earlier chosen project.	Computer and internet facilities.
General Objective 10: Understand the strategies for consolidation and expansion of a business enterprise						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
14	10.1 Explain the justification for business diversification and expansion. 10.2 Explain the process of growth, diversification and expansion in an enterprise. 10.3 Evaluate the strategies for consolidation and expansion of business ventures. 10.4 Explain the	I. Explain the concept of strategy and types of strategy. II. Explain business growth, expansion and diversification. III. Describe strategies for consolidation and expansion of business. IV. Describe the various types of enterprises and their	Text Books	Working in pairs the students should analyze a particular business organization and suggest possible solutions relating to growth and the influence of multinational organizations. Students to make class presentation Identify examples of	Use a case study history of the development of a Nigerian business to show the stages of growth, diversification and development. Focus on a chosen industry and the need to diversify. Organise/project presentation sessions and guide students to analyse	Use of internet and relevant video clips TV, Video/CD

	characteristics of franchise, license and patent systems of enterprise. 10.5 Explain how multinational companies operate. 10.6 Explain how to do business across Nigerian borders.	mode of operation. V. Explain the characteristics of franchise, licensing and patents. VI. Relate franchising, licensing and patents to the operations of multinational corporations. VII. Explain: - International trade policies and laws - Foreign cultures - International trade finance		franchise and license operations in Nigeria. Identify national and international bodies responsible for patents.	the project. Guide students to search the web on the operations of franchises, licenses and patents. Invite Officials of NEXIM, NEPC, NEPZA to address the students on their operations. Guide students to analyse franchise and licensing opportunities..	
General Objective 11: Understand the need for management and business succession plan						
Week	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
15	11.1 Explain management succession plan and reasons for corporate formations. 11.2 Explain the value of continuity and perpetuity in enterprise. 11.3 Explain Exit planning.	I. Describe the concept of management succession plan. II. Explain the benefits of employee participation in corporate ownership.		Prepare a hypothetical succession plan for a business Describe steps needed to elect Board of Directors for a company	Guide students to prepare a succession plan. Guide students to negotiate an exit plan. Guide students to elect Board of Directors and role play a boardroom session.	
ASSESSMENT CRITERIA						
EXAMINATION 60		CONTINOUS ASSESSMENT 40		Other (Examination/ project/ portfolio) %		

PROFESSIONAL ETHICS

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORTATION	**Course Code: TRT 327, SET 218**		**Contact Hours: 2**
	Subject/Course: PROFESSIONAL ETHICS			**Theoretical: 2 hours/week**
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Distinguish between profession, professionalism and transportation evolution
2. Know the requirement for the practice of the profession.
3. Understand the responsibilities of the transportant.
4. Know the various laws relevant to the practice of the profession.
5. Know the code of professional conduct and practice of transportation
6. Understand professional work ethics.
7. Understand ethical standards and behaviours
8. Know the difference between ethics and morality.
9. Understand the roles of Professional bodies, Government in promoting and regulating ethical practices

	Course: PROFESSIONAL ETHICS	**Course Code: TRT 327, SET218**		**Contact Hours: 1Hr**

				Theoretical: 2 hours/week		
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: hours /week*		
	Theoretical Content			*Practical Content*		
	General Objective 1: Distinguish between profession, professionalism and transportation evolution					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 -2	1.1 Define the terms: profession and professionalism. 1.2 Know the historical evolution of transportation in the world. 1.3 Know the historical background of transportation in Nigeria. 1.4 Understand the factors that led to the evolution of transportation in general. 1.5 Relate how these factors have influence transportation in modern time.	i. Explain the terms profession and professionalism and distinguish between them. ii. Explain the historical evolution of transport in ancient and modern times. iii. Compare transport in both ancient and modern times with practical examples.	Books, Journals and Internet	Brain storming session	Lead and correct students, promote debates	
	General Objective 2: **Know the requirement for the practice of the profession**					
3-4	2.1 Explain transport as a profession. 2.2 Know the qualifications required to practice the profession. 2.3 Explain the scope and limitations of the profession. 2.4 Know the role of government in transportation.. 2.5 Explain the implication of the roles on the practice of the profession	i. Explain the transport profession.	Books, Journals and Internet			
	General Objective 3: **Understand the responsibilities of the transportant**					
	3.1 Define transportant. 3.2 Identify the responsibilities of a	i. Define transportant. ii. Explain the	Books, Journals and			**.**

5-6	transportant. 3.3 Know the limitations of transportation.	responsibilities and limitations of transportant. iii. Explain the limitations of transportant.	Internet			
	General Objective 4: **Know the various laws relevant to the practice of the profession**					
7	4.1 Know the laws establishing the Chartered Institute of Logistics and transport (CILT) in Nigeria and UK. 4.2 Understand the contents of these laws.	i. Compare laws related to CILT in Nigeria and UK. ii. Explain the relationship between CILT in the UK and Nigeria	Laws of the Chartered ILT in UK and Nigeria CILT Handbook			
	General Objective 5: **Know the code of professional conduct and practice of Transportant**					
8-9	5.1 Know the code of professional conduct and practice of the profession. 5.2 Understand the code's in all activities of the transportant. 5.3 Identify professional integrity in the code of professional conduct and practice. 5.4 Explain the professional obligations in the code of professional conduct and practice.	i. Explain the significance and contents of the code of professional conduct and practice of the CILT in Nigeria. ii. Explain the code application in professional practice. iii. Explain professional integrity, protocol professional obligation and ethics in the profession. iv. Compare the code of professional conduct in Nigeria and the UK.	Professional code of conduct and practice in Nigeria and the UK CILT handbook			
	General Objective 6: Understand professional work ethics					
10	6.1 Define professional ethics and professional work ethics. 6.2. Understand how ethics relates to professional practices.	a) Define and explain professional ethics and professional work ethics.		Group discussion on ethical	Guide the discussion. Role-plays	

	6.3 Know the ethics of the profession.	b) Explain details 6.2 and 6.3		behaviour. Group discussion on case studies.	Guide the case studies.	
	General Objective 7: **Understand ethical standards and behaviours**					
11	7.1Know ethical principles 7.2 Know positive work ethics. 7.3 Know negative work ethics.	- Explain different ethical principles e.g. honesty, efficiency promptness, etc. -Explain positive work ethics e.g. Self Disciple, politeness, self-commitment, e.t.c Explain negative work ethics. E.g., abuse of trust, recklessness, rude to passengers, etc.	Recommended text books, Lecture notes, related journals and materials and internet			
	General Objective 8: **Know the difference between ethics and morality**					
12	8.1 Define morals 8.2 Know the different between ethics and morality.	Highlights the difference(s) between ethics and Morality in transport profession.	8.1 Define morals 8.2 Know the different between ethics and morality.			
	General Objective 9: **Understand the roles of Professional bodies, Government in promoting and regulating ethical practices**					

13	9.1 Describe role of professional bodies, and government in promoting and regulating ethical practices 9.2 identify government and bodies involved in regulating ethics	Explain 9.1 in details List and explain 9.2				

Assessment: Give details of assignments to be used:

Coursework/ Assignments 10%; Course test: 30%; %; Examination 60%

Recommended Textbooks & References:

PROGRAMME: **HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**

COURSE: RESEARCH METHODOLOGY

COURSE CODE: CEC 401

Contact Hours: 2HOURS/WEEK (1-0-1)

Goal: The overall goal of this course is to acquaint students with skills for Research and Project Report Writing.

General Objectives:

1.0 Select a research topic.

2.0 Formulate a Research Problem.

3.0 Know theoretical/conceptual basis of Research.

4.0 Know how to analyze data

5.0 Know how to present information/data

6.0 Know how to analyze data

7.0 Know how to write a research work or project.

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
Course: Research Methodology		**Course Code:** CEC 401		**Contact Hours:** 1 – 0 – 1		
	Theoretical Content: 1 hr			**Practical Content: 1 hr**		
WEEK	**General Objective 1.0: Select a research topic**					
1	**Specific Learning Outcome**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
	1.1 Explain the criteria for choosing a Research topic 1.2 Choose a project or research topic relevant to the area of specialization.	Advise students on choice of project.	Reference Books Project layout Examples Library books	Choose a project or research topic relevant to the area of specializatio n.	Guide students in the choice of suitable research topics.	Reference Books Project layout Examples Library books
WEEK	**General Objective 2.0: Formulate a Research Problem.**					
2	2.1 Define a Research Problem.	Advise students on choice of	Reference Books	Formulate study	Guide students in	Reference Books

	2.2 Explain aspects of Research Problem 2.3 Formulate study objectives 2.4 Define study area.	project.	Project layout Examples Library books	objectives	various steps towards achieving research objectives.	Project layout Examples Library books
WEEK	**General Objective 3.0: Know theoretical/conceptual basis of Research.**					
3	3.1 Situate research within the framework of theories, models and concepts. 3.2 Discuss importance of literature review. 3.3 Visit library to obtain literature materials.	Advise students on choice of project.	Advise students on choice of project.	-	-	-
WEEK	General Objective 4.0: Know how to Analyse data.					
4	4.1 Mention main sources of data. 4.2 Discuss techniques of data collection: a. Laboratory. b. Field survey/measurement c. Questionnaire d. Oral interviews.	Guide student on project Presentations	Advise students on choice of project.	-	-	-
WEEK	**General Objective 5.0: Know how to present information/data**					
5-8	5.1 Explain how to present data in a manner suitable for research in the following form: Tables, Graphs, Charts, bars 5.2 Input information into computer. 5.3 Print out results.	Guide student on project Presentations	Computers Software	Present data in a manner suitable for research in the following form: Tables, Graphs, Charts, bars	Give Sample of Research Data for students to work on. 15 minutes Presentation by each	Reference Books Project layout Examples Library books

					student.	
WEEK	General Objective 6.0: Know how to analyse data					
9-11	6.1 Use mathematical tools to find means, averages, peak. 6.2 Draw inferences and make projections. 6.3 Analyze some specific data as examples.	Guide student on project Presentations	Computers Software	Analyze some specific data	Give Sample of Research Data for students to work on. 15 minutes Presentation by each student.	Computers Software
WEEK	**General Objective 7.0: Know how to write a research work or project**					
12-15	7.1 Explain contents of preliminary page Title, Approval page Dedication, Acknowledgement, Abstract, Table of Contents, List Figures, List of plates, List of Tables. 7.2 Explain how to write Introduction. 7.3 Explain how to write the literature review. 7.4 Explain how to write the methodology. 7.5 Explain how to write the main body of the work. 7.6 List findings, recommendation and conclusions. 7.7 List references. 7.8 Present a summary paper. 7.9 Appendices 7.10 Defend the project.	Analyze some specific data	Computers Software	Present a summary paper.	Guide students to present summary paper based on the topic chosen in Week 1.	Reference Books Project layout Examples Library books

Assessment: Coursework 20%; Course test 20%; Practical 20%; Examination 40%

Competency: The student should be able to write an acceptable final year diploma project in Transport Technology.

Reference: J.Bingham, "Mastering Data Processing", McMillan Edc. Lt. 1986

TRANSPORT SYSTEM MANAGEMENT

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 328**		**Contact Hours: 2**
	Subject/Course: TRANSPORT SYSTEM MANAGEMENT			**Theoretical: 2 hours/week**
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Know the concept of transport management
2. Understand Transport System and Sub-Systems
3. Understand Transport Management Principles and their Application
4. Understand Transport Regulation and Practice
5. Know the Organization and Management of Transport System Terminals
6. Know Transport Operation and Control
7. Know Security and safety measures

	Course: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 328**			**Contact Hours: 2**	
					Theoretical: 2 hours/week	
	Year: 2 Semester: 2	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Know the concept of Transport Management					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 -2	1.1 Define Management 1.2 State the functions of elements of Management e.g. Planning, Organizing, and Forecasting etc. 1.3 Explain the concept of Management in transport system e.g. organizing transport office, managing a transport problem etc.	i. Define Management concept ii. Explain Management elements	Books, Journals and other Relevant Materials	1 -2		
	General Objective 2: Understand transport system and sub-systems					
3-4	2.1 Explain transport system: Road, Air, Sea, Rail, Pipeline 2.2 Identify the sub-systems of the system 2.3 Explain the role of transport management agencies in the transport	i) Explain Transport System ii) State The Sub-Systems Of Each Of The System iii) Explain The Role Of Transport Management				

	system	Agencies				
	General Objective 3: Understand transport management principles and their application					
5	3.1Explain transport management 3.2Explain the basic principles of transport management	i. Explain transport management ii. Explain the principles of transport management				.
	General Objective 4: understand regulation and practice					
6-7	4.1 Explain Transport regulation 4.2 Explain Transport regulation practice 4.3 Explain transport regulation practice in developing countries 4.4 Explain transport regulation practice in developed countries	i. Explain the concept of transport regulation i. Compare the transport regulation practice in both developing and developed countries	Text books Journals			
	General Objective 5: Know the organisation and management of transport system terminals					
8-9	5.1 Define Terminal 5.2 Outline the factors to be considered for the location of terminals 5.3 State various types of terminals, their parts and functions 5.4 Describe the characteristics and organization of transport terminals	i. Define terminal ii. List the factors of terminal location iii. Enumerate various types of terminals, their components and functions iv. Explain the characteristics of transport terminals				
	General Objective 6: Know transport operation and control					
10	6.1 Explain the transport operation 6.2 Explain the control of transport operation	i) Describe the nature and types of transport operations ii) Explain the control of transport operations				
	General Objective 7: Know Security and safety measures					

11-12	4.1 Describe vehicle tracking system 4.2 understand on-board computer information 4.3 know over-the-air (OTA) security 4.4 describe preventative measures to address cargo damage and loss 4.5 describe Remote vehicle disabling systems 4.6 identify emergency notification systems 4.7 understand the effects of Drugs and fatigue	Explain vehicle tracking and the systems used Explain on-board information Explain how to operate vehicle security when stopped and how to safely disable a vehicle while in operation Explain fleet and security control Explain how to disable vehicles engine from working with remote sensors Explain how to use panic button to send information Explain fatigue in details, and discuss effects of drugs				

Assessment: Coursework/ Assignments 10 %; Course test: 30 %; Examination 60 %;

Recommended Textbooks & References:

WORKSHOP MANAGEMENT

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT329**		**Contact Hours: 3**
	Subject/Course: Workshop Management			**Theoretical:1 hours/week**
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: 2 hours /week*

General Objectives

1. **Discuss workshop supervision**
2. **Discuss loading and Schedules**
3. **Explain automobile workshop staff organization**
4. **Explain the basic types of organization structure**
5. **Discuss the responsible of technical adviser schedules**
6. **Discuss the concept of planning and control**
7. **Explain the use of time sheet**
8. **Understand the capital expenditure budget proposal**
9. **Discuss direct costs and indirect costs**
10. **Discuss human relations & industrial psychology.**

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY		
COURSE: WORKSHOP MANAGEMENT	**Course Code: TRT329**	**Contact Hours: 1-0-2 Hrs/Wk**
Course Specification: THEORETICAL CONTENT	**PRACTICAL CONTENT**	

Week	General Objective: 1.0: Discuss workshop supervision management			General Objective: Identify Component parts of spark ignition engine.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
1	1.1 Describe single workshop organization chart. 1.2 Explain workshop procedure and its application. 1.3 Discuss workshop procedure and controls.	· Explain the feature of a workshop organization chart. · Distinguish the various features in a workshop. · Assess the students on a workshop procedures & control.	Whiteboard and Marker Textbook Automotive /Journal (internet)			
Week	**General Objective: 2.0: Discuss loading and Schedules**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
2-3	2.1 Explain simple chart of events in the workshop. 2.2 Explain the function of reception tech. In the workshop. 2.2 Explain the process of work schedule.	· Explain and ask students to draw a simple chart of events in the workshop and its hierarchy and their functions. · Assess the students on the organo gram of the workshop. · Evaluate students on allocation of	Whiteboard & Maker Workshop Journal i.e IMI-SAE- (Internet)			

		work schedule.				
Week	**General Objective: 3.0 Explain automobile workshop staff organization.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
4	3.1 Describe automobile workshop staff Organization.	· Guide students on the organization of staff in an automobile workshop. · Assess to produce simple workshop organogram.	Whiteboard & Marker Sample of organogram Textbook			
Week	**General Objective: 4.0 Explain the basic types of organization structure**.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
5	4.1 State the various types of organization structure. 4.1 Draw and label organization structure.	· Explain using diagrams various types of organization structure.	Flip chart White Board Organ Chart Model Textbooks			
Week	**General Objective: 5.0 Discuss the responsible of technical adviser schedules**.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
6	5.1 Discuss methods of workshop loading.	· Explain requisition form. · Guide students to	Whiteboard & Marker			

	5.2 Explain the procedure for ordering posts.	know responsibility schedule.	Job order form			
Week	**General Objective: 6.0 Discuss the concept of planning and control**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
7	6.1 Understand the concept of planning and control. Differentiate planning and control.	· Explain and ask students the concept of planning. · The difference between planning and control.	Whiteboard & Marker Textbook Supervisor Management			
Week	**General Objective: 7.0 Explain the use of time sheet.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
8	7.1 Discuss the importance of time sheet.	· Explain and ask students the importance of time sheet.	Sample of time sheet.			
Week	**General Objective: 8.0 Understand the capital expenditure budget proposal.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
9-10	8.1 Explain the concept	· Explain and ask students the	Sample of Capital			

	of capital expenditure budget proposal. 8.2 Draw up list of materials of expenditure budget proposal.	concept of capital expenditure budget proposal. · How to arrange materials of capital expenditure budget proposal.	expenditure proposal. Whiteboard & Maker			
Week	**General Objective 9.0 Discuss direct costs and indirect costs.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
11	9.1 Explain direct costs and indirect costs.	· Explain and ask students to differentiate between direct and indirect cost.	Whiteboard & Marker Textbook on Supervisor Management Flip Chart			
Week	**General Objective 10.0 Discuss human relations & industrial psychology.**					

	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
12	10.1 Explain human relations and industrial psychology (details of bonus scheme sing a four-part job card set). 10.1 Explain customer relations.	· Explain and ask students to enumerate human relations and industrial psychology. · Assess students.	Whiteboard & Marker Textbook on Supervisor Management Flip Chart			
Week	**General Objective: 11.0 Explain the concept of Motivation**.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
13	11.1 Explain elements of motivation. 11.2 Discuss MASLOW Hierarchy of needs.	· Explain and ask the students to state the elements of motivation. · MASLOW needs.	Whiteboard & Marker Flipchart			

Competency:

1. Draw various diagrams of organization structure.

2. Prepare a specimen of a crook schedule.

3. Prepare a capital expenditure budget proposal.

Assessment: Coursework/ Assignments 10 %; Course test: 30 %; Examination 60 %

Recommended Textbooks & References:

Electrical and Computer Courses

FUNDAMENTAL OF AUTO-ELECTRIC SYSTEMS

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: MCE 108**		**Contact Hours: 3**
	Subject/Course: **FUNDAMENTAL OF AUTO-ELECTRIC SYSTEMS**			**Theoretical: hours/week**
	Year: *Semester:*	*Pre-requisite:*		*Practical: hours /week*

General Objectives

10. **Know the Requirements, Designs and Operations of Automotive Starters Batteries**
11. **Know the Requirements, Construction, Types and Operational .principles of Modern Automotive Charging System.**
12. **Understand the General Operational principles of the Starting System**
13. **Understand the Lighting System Principles of the Motor Vehicle.**

	Course: FUNDAMENTAL OF AUTO-ELECTRIC SYSTEMS	**Course Code: MCE 108**		**Contact Hours: 3**

				Theoretical: 1 hours/week
	Year: *Semester:*	*Pre-requisite:*		*Practical: 2 hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
COURSE: FUNDAMENTAL OF AUTO-ELECTRIC SYSTEMS			**Course Code: MCE 108**		**Contact Hours: 1- 0-2 Hr/wk**	
Week	**General Objective 1.0: Know the Requirements, Designs and Operations of Automotive Starters Batteries**					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1 – 4	1.1 State the function and purpose of a battery. 1.2 Explain the construction of a lead-acid cell. 1.3 Discuss the chemistry of charging and discharging processes.	. Explain in details the features, functions, chemistry of charging/ discharging, principle .of operations of a battery. . Illustrate the procedures for connecting and disconnecting batteries to and from modern vehicles to avoid loss of stored	Recommended textbooks, lecture notes, white board, marker, duster, charts etc.	1.1 Carryout battery charging process. 1.2 Carry out battery capacity and functionality test. 1.3 Demonstrate modern procedures for connecting and disconnecting batteries to and from modern	. Demonstrate activities 1.1 to 1.3 for the students to learn and allow them to practice till they become competent. . Grade students' reports, practical works, sketches and drawing.	Batteries, battery charging, equipment, manuals, etc.

	1.4 Explain the process of electrolyte preparation. 1.5 Discuss battery charging process. 1.6 State and explain factors which affect battery life. 1.2 Discuss general safety precautions when handling automotive batteries. 1.3 Explain modern procedures for connecting batteries and disconnecting batteries to and from modern vehicles to avoid loss of stored system codes and	systems codes and information. • Ask the students to illustrate the procedures indicated above. • Mark students graded assignments.		vehicles to avoid loss of stored system codes and information.		

	information.					
	General Objective 2.0: Know the Requirements, Construction, Types and Operational .principles of Modern Automotive Charging System.					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5 – 8	2.1 State the purpose of the charging system and list components that make up the system. 2.2 Outline common types used in vehicles. 2.3 Discuss principles of generator operation. 2.4 Differentiate between generators and alternators. 2.5 Highlight the limitations of the dynamo.	· Explain in details the features, circuits, components, types, functions and principles of operations of charging system and its accessories. · Illustrate the methods of carrying out functionality test of charging system. · Assess students graded assignments.	Recommended textbooks, lecture notes, markerboard, marker, duster, charts, etc.	2.1 Identify a typical charging system of a modern vehicle, its components and Functions 2.2 Carry out functionality test of the system. 2.3 Dismantle, service and reassemble a modern alternator and test for functionality.	· Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to carryout all the activities. · Grade students' reports, practical works, sketches and drawings.	Complete tool box Manuals

	2.6 Explain the methods of carrying out functionality test of the system. 2.7 Explain a typical charging system circuit diagram.					
	General Objective 3.0 Understand the General Operational principles of the Starting System.					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
9 – 11	3.1 State the function of the starting system and list the components that make up the system. 3.2 Discuss the D.C motor principles of operation. 3.3 Explain power, torque and current requirements for	· Explain in details the features, functions, principle of operations and frequency of use of starting system. · Illustrate common faults associated with the starting system and possible remedies. · Assess	Recommended textbooks, lecture notes, markerboard, duster, charts etc.	3.1 Identify the starting system, its components and functions s. 3.1 Dismantle, service, reassemble and test a typical. starter motor for functionality.	· Demonstrate activities 3.1 to 3.2 for the students to learn and allow them to practice till they become competent.	Complete tool box. Starting system equipment Manuals

	starting. 3.4 Mention types of starter motors in use. 3.5 State common faults associated with the starting. 3.6 Discuss the duration and frequency of use the starting circuit.	students graded assignments.				
	General Objective 4.0 Understand the Lighting System Principle s .of the Motor Vehicle.					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
12 – 15	4.1 Explain the need for the lighting system in vehicles.	. Explain in details the features, need, legal requirements, types and	Recommended textbooks, lecture notes, markerboard, marker, duster, charts etc.	4.1 Identify a typical lighting system circuits, its	. Demonstrate activities 4.1 and 4.2 for the students to learn and allow then to practice	

	4.2 Discuss the legal requirements for an ideal lamp and their effects. 4.3 Give reasons for the following:- · Writing of lamps in parallel. · Anti-dazzle controls. · Use of dipped and main beams. 4.4 Discuss the need for: a. Overload protection. b. Fuses, their uses and Sizes. c. Headlamp relays. 4.5 Explain the principle of direction indicating devices e.g. the flasher unit.	principles of operation of lighting system. · Illustrate the need for overload protection, fuses and headlamp relays. · Assess the students graded assignments.		components and functions. 4.2 Demonstrate fault tracing on lamp circuits.	till they become competent. · Grade students' reports, practical works, sketches and drawings.	

Competency

1. Perform experiment on a single loop d.c.
2. Use electrical measuring tools.
3. Draw simple electric circuits.
4. Repair an alternator and starter motor.

Assessment:

Reference:

Fundamental Automotive Electronics: V.A.W. Hiller

Automobile Electrical Electronic systems: By Tony Tranter

Electronic Diesel Control EDC (Automotive Technology): By Bosch

Control System I

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: MCE 208**		**Contact Hours: 3**
	Subject/Course: Control System I			**Theoretical: hours/week**
	Year: *Semester:*	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand the general concepts of control systems

2. Understand block diagram representation of control systems

3. Understand the deviation of transfer functions of control elements/systems

4. Understand Components and transducer commonly used in Control systems.

5. Understand the simplification of block diagram and its application

6. **Know time response of first and second order control systems and their applications**

7. **Understand frequency response of a linear control system element.**

	Course: Control System I	**Course Code: MCE 208**		**Contact Hours:**
				Theoretical: hours/week
	Year: 3 Semester:1	*Pre-requisite:*		*Practical: hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY					
	Course: Control System I	**Course Code: MCE 208**		**Contact Hours: 2/0/3**	
	Course Specification: Theoretical Content				
WEEK	**General Objective:1.0 Understand the general concepts of control systems**		**General Objective: 1.0 Determine by experiments the basic principles of control systems.**		
1-2	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
	1.1 Outline the common features of control systems (input,	· Discuss with the students the importance of	Writing materials, recommended textbooks,			

	process, output). 1.2 Give typical example of control systems in: Engineering Medical Sciences Management Sciences 1.2 Explain open loop and closed loop control systems. 1.3 Give typical examples of systems listed in 1.3.	control systems in various domestic, commercial and industrial environments .	Magnetic writing boards, lecturer notes.			
3-4	**General Objective 2. 0 Understand block diagram representation of control systems.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
	2.1 Explain composition of an open-loop system:- i. Reference signal or input signal ii. Process or plant iii. Controlled output 2.1 Explain composition of a simple closed loop system:- i. Reference signal or input signal; ii. Process or plant	· Explain the significance of open loop and closed loop systems in engineering control systems · Ask students to draw the block diagrams of common engineering control systems.	Writing materials, recommended textbooks, lecturer notes magnetic writing board.			

	iii. Control output iv. Feedback signal v. Comparator or Summing element vi Error signal or actuating signal 2.2 Draw block diagrams of some engineering control systems, e.g.:-Water – level Control system: Refrigerator and air – conditioner.					
	General Objective 3.0 Understand the deviation of transfer functions of control elements/systems.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
	3.1 Define transfer function of control system. 3.2 Explain the general methods of deriving the differential equation of a given control element e.g. RC passive network. 3.1 Derive transfer function in the plane (lap lace transform), for the following systems.	• Give assignments to students on transfer functions.	Writing materials, recommended textbooks, lecturer notes, magnetic board			

	i. RC, RL, RLC Circuits, and ii. potentiometer i. Active networks involving operational amplifier iv. Field controlled and armature – controlled motors v. D.C generator vi. Simple mass- spring damper system, and simple gas system. vii. Thermal system viii. Hydraulic system ix. Pneumatic system x. Complex systems xi. Single-capacity system xii. Multi-capacity system					
	General Objective 4.0 Understand Components and transducer commonly used in Control systems.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
	4.1 Explain the principle of operation and characteristics of the following as control elements:	· Discuss the importance of control elements in control elements in	Writing material, recommended textbooks lecture notes, magnetic writing board.	4.1 Perform experiments to illustrate transducers as	· Teachers should involve the students in the experiments	Control and Instrumentation laboratory, machines laboratory, practical notebook/logbooks,

	i. resistive and inductive potentiometers; ii. Linear variable differential iii. transformer; iv. Tachogenerator; v. Thermocouple and resistance vi. thermometers vii. Strain gauges; viii. Thermistor ix. Photo resistor, photo-diodes, x. photo- transistors xi. Magnetic amplifiers. xii. 4.2 State the field of application of the Component in 4.1 above.	control systems		control elements.	• Ask the students to submit their reports for assessment.	practical manuals.
	General Objective 5.0 Understand the simplification of block diagram and its application.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
8-9	5.1 Explain with a block diagram, the canonical form of a feedback control system. 5.2 Derive expressions for the following:- i. Closed –loop transfer function; ii. Primary feedback; iii. Error ratio; iv. Characteristic equation. 5.3 Explain the following transformation theorems:- i. Blocks in Cascade; ii. Blocks in parallel;	• Ask students to apply transformation theorem to reduce complex block diagrams to simple block diagrams. • Discuss the practical application of feedback control system.	Magnetic writing board, Writing materials, recommended textbooks, and lecturer notes, drawing materials.			

	iii. Moving a summing point a head of a point; iv. Moving a summing point behind a block; v. Moving a take off point ahead of a block; vi. Moving a take off point behind a block; vii. Reducing a feedback loop. 5.4Apply transformation theorems to reduce complex block diagrams. 5.5 Derive the transfer function of the reduced block diagram in 5.4 above. 5.6 Derive the output signal of a control system with more than one input. 5.2 Derive error ratio (ε) from a given close loop control system.					
	General Objective 6.0 Know time response of first and second order control systems and their applications.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
10-13	6.1 Explain time response of a control system as a	· Ask students to solve problems on transient and	Writing materials, lecturer notes, magnetic board,	6.1 Carry out experiment to determine the time response of first	· Teachers should involve the students in	Control and Instrumentation laboratory, machines laboratory, practical

	combination of transient and steady state response. 6.2 Define the type of test signals used for time response i.e. i. Step ii. Ramp iii. Impulse iv parabolic v. Sinusoidal. 6.3 Classify control systems according to type, order and class. Derive the time response of a first order system to signals in 6.2 (i) to (iii). 6.5 Sketch the output response of first order systems to input in 6.2 (i) to (iii). 6.6 Derive the time response of a second order system to a step input 6.7 Sketch output response of a second order system to a step input. 6.8 Explain using the sketch in 6.7, the following terms;	steady state response of control system. · Discuss the output response of control systems under various test signals in 6.2. · Explain the characteristics of first order system and second order system.	recommended textbooks.	and second order control systems.	the experiments · Ask the students to submit their reports for assessment.	notebook/logbooks, practical manuals.

	i. Overshoot ii. Period of damped oscillation; iii. Rise time; iv. Settling time. 6.9 Define damping ratio. 6.10 Discuss the effects of different values of damping ratio on the response in 6.7 above. 6.11 Explain the standard transfer function of a second over system. 6.12 Write down expressions for Maximum overshoot Time to successive overshoots and undershoots; Setting time 6.13 Solve problems involving 6.11 and 6.12 above. 6.14 Evaluate steady state error for first order and second order systems. 6.15 Identify the problems associated with control system e.g. Transmission lag,					

	process lag and Measurement lag.					
	General Objective 7.0 Understand frequency response of a linear control system element.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
10-13	7.1 Explain frequency response of a system. 7.2 Describe a laboratory test method to obtain the open-loop frequency response of a linear control system. 7.3 Explain how Nyquist diagram can be plotted from given amplitude and phase data G (jw) = A (w) Q(w). 7.4 Explain how Nyquist diagram can be sketched for systems with transfer functions of form $G(s) = \frac{K}{Sn (1+ST) M}$ 7.5 Explain the method of drawing Bode diagrams from given amplitude and phase data G	· Ask the students to plot Nyquist diagrams from: Amplitude and phase data. Transfer functions · Ask the students to plot Bode diagrams from given amplitude and phase data. · Solve problems on frequency response of control systems.	Recommended textbooks, writing materials, lecture notes, magnetic board, drawing materials.	7.1 Perform an experiment to illustrate Bode diagram.	· Teachers should involve the students in the experiments. · Ask the students to submit their reports for assessment.	Control and Instrumentation laboratory, machines laboratory, practical notebook/logbooks, practical manuals.

	(jw) = A (w)/Q (w). 7.6 Explain the asymptotic plot of Bode diagrams Amplitude plot A(w) Phase plot Q (w) 7.7 Define gain margin and phase margin of System from: i. Nyquist diagram ii. Bode diagram 7.8 Solve problems on Bode diagrams.					

Competency: The student should be able to simulate control systems in automotive and related systems.

Assessment: Course work 20%, Course tests 20%, Practical 20%, Exam 40%

Reference: Modern control system by Richard. C. Dorf and Robert. H. Bishop.

Computer Aided Design and Drafting

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: COM 201**		**Contact Hours: 3**
	Subject/Course: Computer Aided Design And Drafting			**Theoretical: hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand the use of computer in the design and drafting process.

2. Understand how to construct simple geometric shapes

3. Understand the different edit boxes

4. Understand how to use edit commands

5. Understand how to create layers

6. **Understand how to create linear and aligned dimensions**

	Course: Computer Aided Design and Drafting	**Course Code: COM 201**		**Contact Hours: 3**
				Theoretical: hours/week
	Year: 1 Semester:2	*Pre-requisite:*		*Practical: hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY		
COURSE: Computer Aided Design And Drafting	**Course Code: COM 201**	**Contact Hours: 0-0-3 Hrs/Wk**

Course Specification: Theoretical Contents				Practical Content:		
	General Objective 1.0: Understand the use of computer in the design and drafting process.			General Objective:		
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.	· Explain advantages and disadvantages of computer in the design process. · Explain the links between CAD and CAM. · Show the students the main parts of the screen of Auto CAD 14. · Explain the function of the above. · Ask the students to explain and use the different input methods. · Ask students to explain differences between Cartesian and polar coordinates systems. · Ask students to demonstrate the above options on the computer screen. · Ask students to construct lines at set lengths and angles using above	Complete Computer Sets. 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students. Manuals, 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 Demonstrate the uses of 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 Show how to save drawings on demand and also how to set up	· Provide the students the AutoCAD CDROM for the inatallation.	Complete Computer Sets, 1 Computer to 2 Students, 1 Large Printer or Plotters in a Network, 1Digitizer to 2 Students.

		coordinate systems. · Ask students to use snap points to construct lines. · Ask students to explain the use of snap points and ortho-commands. · Assess the students.		the auto-save features.		
	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 Know 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 to given dimensions. 2.4 Produce a simple drawing – Drawing 1.	· Ask the students to hatch the shapes drawn. · Ask the students to change the hatch pattern and scale. · Ask the students to draw circles, ellipse and arc to given dimensions.	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.	2.1 Produce a simple drawing.	· Ask the students to construct polygons and squares to a given dimensions.	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.	· Ask students to explain the different edit boxes. · Ask students to use them. · Ask students to explain their attributes. · Ask students to draw both polar and rectangular arrays using array command. · Ask students to draw using the offset command.	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.	3.1 Use array command to draw both polar and rectangular arrays.		
	General Objective 4.0: Understand how to use edit commands.			**General Objective**:		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
6	4.1 Explain how to use edit commands. 4.1 Demonstrate how to move objects accurately; using both snap commands and	· Demonstrate the installation of MD Word · Identify the different features of the software. · Ask students to type	Complete Computer Sets 1 Computer to 2 Students 1 Large Format	4.1 Demonstrate how to move objects accurately; using both snap commands and	· Demonstrate the installation of MD Word · Identify the different features of the software.	

	coordinates. 4.2 Demonstrate how to copy objects from one position to another accurately using snap and coordinate entry. 4.4 Demonstrate how to erase object. 4.5 Demonstrate how to trip objects. 4.4 Demonstrate how to fillet and chamfer angles.	a short document and save it. · Ask student to edit a document and carry out a spell check. · Demonstrate the use of tables.	Printer or Plotters in a Network 1 Digitiser to 2 students.	coordinates. 4.2 Demonstrate how to copy objects from one position to another accurately using snap and coordinate entry. 4.3 Demonstrate how to erase object. 4.4 Demonstrate how to trip objects.	· Ask students to type a short document and save it. · Ask student to edit a document and carry out a spell check. Demonstrate the use of tables.	
	General Objective 5.0: Understand how to create layers			**General Objective:**		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
7-8	5.1 Demonstrate how to create layers. 5.2 Demonstrate how to change colour of layers. 5.3 Demonstrate how to change the line types of a layer. 5.4 Demonstrate how to move objects from one layer to another. 5.5 Demonstrate how to switch layers on and off.	· Ask students to create layers. · Ask students to change colour of layers. · Ask students to change the line type of a layer. · Ask students to move objects form one layer to another. · Ask students to switch layers on an off.	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.	5.1 Demonstrate how to create layers. 5.2 Demonstrate how to change colour of layers. 5.3 Demonstrate how to change the line types of a layer. 5.4 Demonstrate how to move objects from one layer to another. 5.5 Demonstrate how to switch layers on and	· Ask students to create layers. · Ask students to change colour of layers. · Ask students to change the line type of a layer. · Ask students to move objects form one layer to another. · Ask students to switch layers	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.

	5.6 Understand the use of layers and how they help in the construction and understanding of a draw.	• Ask students to use layers to construct drawings.		off. 5.6 Understand the use of layers and how they help in the construction and understanding of a draw.	on an off. • Ask students to use layers to construct drawings.	
	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	6.1 Explain how to create linear and aligned dimensions. 6.2 Understand how to create angular dimensions. 6.3 Demonstrate how to add to tolerances to dimension. 6.4 Demonstrate how to create leader lines. 6.5 Demonstrate how to add single line and multiple line texts to drawings. 6.5 Demonstrate how to edit dimensions and text.		Sets of Personal Computers Recommended Textbooks Manuals etc.	6.1 Demonstrate how to add to tolerances to dimension. 6.2 Demonstrate how to create leader lines. 6.3 Demonstrate how to add single line and multiple line texts to drawings. 6.4 Demonstrate how to edit dimensions and text.		Complete computer sets, 1 computer to 2 students, 1 large format printer or plotters in a network, 1 Digitiser to 2 students.
	General Objective 7.0:			**General Objective 7.0:**		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning**	**Teachers**	**Resources**

				Outcome	**Activities**	
11 – 14				7.1 Create the title block for a drawing Write letters and numbers on drawings 7.2 Draw circles be able to erase parts lines or circles. 7.3 Produce a simple drawing with correct details in terms of title block etc. 7.4 Select parts of a drawing in order to do further work. 7.5 Move, copy and rotate drawing parts. 7.6 Produce a full drawing with title	· Ask each student to carry out his/her own drawing. · Let each student carry out his/her own drawings. · Ask each student to carry out his/her own drawing. · Ask each student to carry out a drawing that is specific to his/her department. · Assess the students · Grade each student's drawing	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.

				blocks from a real engineered 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.		

Competency: The student should be able to use the computer to draw schematic diagrams, graphic diagrams using object oriented technique.

Assessment: Course work 20%, Course tests 20%, Practicals 10%, Exam 50%.

Reference: Mastering AutoCAD by George Omura

INTRODUCTION TO COMPUTING

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: COM 101**		**Contact Hours: 3**

	Subject/Course:			**Theoretical: 1 hours/week**
	Year: 3 Semester: 1	*Pre-requisite:*		*Practical: 2hours /week*

General Objectives

1. Understand the basic components of the computer and how it has evolved over the year

2. **State the importance and application of operation**

3. **Understand the operation of windows operating system and application packages.**

4. **Understand file management and software package.**

	Course: INTRODUCTION TO COMPUTING	**Course Code: COM 101**		**Contact Hours: 3**
				Theoretical: 1 hours/week
	Year: 3 Semester:1	*Pre-requisite:*		*Practical: 2 hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
COURSE: INTRODUCTION TO COMPUTING			**Course Code: COM 101**		**Contact Hours: 1-0-2 Hrs/Wk**	
Course Specification: Theoretical Contents				**Practical Content:**		
WEEK	**General Objective 1.0: Understand the basic components of the computer and how it has evolved over the year.**			**General Objective:**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

1-4	1.1 Know 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 Understand the input-process- output algorithm with the following in mind: 1. Central Processor 2. Input Mechanism 3. Output Mechanism	• Relate the present idea of computer to other equipment and items that assess man to perform tasks faster. • Trace the historical evolution of computers • Assess the impact of computers to every day living • Conduct the students through the various parts of the computer and how data is managed by the various parts in the system.	Maximum of 4 students to a computer system. Maximum of 4 computers to a printer except when a network is in use. Paper and computer accessories. Magic Board Multimedia projector system			
	General Objective 2.0: State the importance and application of operation systerm.			**General Objective:**		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
5-8	2.1 List the application of the following:	• Explain the need for data storage. • Dismantle a computer system	Maximum of 4 students to a computer system.			

	i. RAM ii. ROM iii. Fixed discs iv. Removable v. MS Office vi Lotus Smart Suite vii. MS Encarta 2.2 Understand the concept of an operating system. i. PC-DOS/MS DOS ii. Windows iii. Linux iv. Unix	and show the students the RAM card, the Hard disk and the processors. · Explain the concept of an operating system.	Maximum of 4 computers to a printer except when a network is in use. Paper and computer accessories. Magic Board Multimedia projector system			
	General Objective 3.0: Understand the operation of windows operating system and application packages.					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
9-12	3.1 Access computers correctly through windows operating system. 3.2 Understand the steps for opening and closing windows.	· Discuss the advantage of windows operating system. · Explain the windows menu and tools. Each student must be given an opportunity to start a	Maximum of 4 students to a computer system. Maximum of 4 computers to a printer except when a network	3.1 Demonstrate the steps for opening and closing windows. 3.2 Use the various windows bars.	· Give opportunity to each student to boot a computer, work on window operating system and	Maximum of 4 students to a computer system. Maximum of 4 computers

	3.3 Understand the application of program manager. 3.4 Know the uses and application of the various windows bars. 3.5 Understand how to move from one window to another and how to operate them concurrently. 3.6 Understand file management and how to manage files. 3.7 Know the step in creating files and folders. 3.8 Understand file manipulation (moving copying saving deleting etc). 3.9 Understand the use of Print Manager. 3.9 Understand the concept of the following software package.	computer, open/close the window operating system, understand the program manager and move around in the windows environment. · Explain the process of creating a file, manipulating the file and use of the print manager. · Assess the student. · Load MS Office with the student and explain the various packages that make up MS office. Load MS Encarta and discuss its use with the student. · Assess the student	is in use. Paper and computer accessories. Magic Board Multimedia projector system	3.3 Create files, folders and manipulate them. 3.4 Perform printing operation using print manager.	shut down the computer. · Assess the students.	to a printer except when a network is in use. Paper and computer accessories. Magic Board Multimedia projector system.
	General Objective 4.0: Understand file management and software package.			**General Objective**:		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

13-15				4.3 Demonstrate ability in the use of a word processing packages such as MS Word or Word Perfect and covering the following: ii. Entering text iii. Formatting text (emboldening font size, italising, etc) iii. Creating and saving text files iv. Importing objects v. Spelling and grammar checking vi. Creating and manipulating tables, text boxes equations. vii. Printing and file export.	· Demonstrate the installation of MD Word · Identify the different features of the software. · Ask students to type a short document and save it. · Ask student to edit a document and carry out a spell check. · Demonstrate the use of tables.	Maximum of 4 students to a computer system. Maximum of 4 computers to a printer except when a network is in use. Paper and computer accessories. Magic Board Multimedia projector system

ELECTRICAL ENGINEERING SCIENCE

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: EEC 115**		**Contact Hours: 3**
	Subject/Course: ELECTRICAL ENGINEERING SCIENCE			**Theoretical: 1 hours/week**
	Year: *Semester:*	*Pre-requisite:*		*Practical: 2 hours /week*

General Objectives

1. Understand the concept of electric current flow.

2. Understand simple dc circuits

3. Understand various types of energy and their inter-relationships

4. Understand the concept of electrostatics, electric charge and capacitance of capacitors

5. State the general concept of magnetism and magnetic circuits

6. Understand the concept of electromagnetism and electromagnetic induction

7. Understand the concept of inductance and its applications

8. Understand the fundamentals of a.c. theory

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
Course: ELECTRICAL ENGINEERING SCIENCE		**Course Code: EEC 115**		**Contact Hours: 1 – 0 – 2 Hrs/Wk**		
Course Specification: Theoretical Content				**Course Specification: Practical Content**		
	General Objective 1.0: Understand the concept of electric current flow.			**General Objective 1.0: Perform experiments on d.c circuits to understand electrical quantities**		
Week	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**	**Specific Learning Outcome:**	**. Teacher Activities**	**Learning**
1-2	1.1 Define an atom. 1.2 Explain the structure and composition of an atom 1.3 Differentiate between conductors, insulators and semi- conductors. 1.4 Explain the concepts of current and electron flow. 1.5 Define electric current, potential difference electromotive force (e.m.f) and resistance, state their units and symbols. 1.6 State multiples and sub-multiples of Electric quantities; (e.g.	• Draw atomic structure to explain to the student its composition. • Explain the electron mobility • Draw the atomic structure to explain the unique differences in their structure. • Explain with the aid of diagrams how the current &	Marker Board, marker, recommended Textbook, Charts, writing materials, calculator.	1.1 Perform experiment on a single loop d.c circuit with variable e.m.f	. Teachers should ensure that necessary precautions are taken during the experiment.	Resistors, capacitor, voltmenter ohmmeter, cable emf sources, thermometer, practical notebook, practical manual.

	Mega 10^6, kilo- 10^3, etc)	electron flow. • Write down the formulae and symbols for current flow, p.d. or e.m.f., resistance. • Explain them to the students. • Explain quantities of electricity and their units.				
	General Objective 2.0: Understand simple dc circuits					
Week	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**	**Specific Learning Objectives**	**Teacher Activities**	**Resources**
3-4	2.1 Define d.c. current. 2.2 State the analogy between current flow and water flow. 2.3 Describe basic d.c. circuits .2.4 Explain Ohm's law. 2.5 Solve problems using	· State the definition of current. · Explain how flow of current is similar to the flow of water. · Draw the basic d.c	Marker Board, marker, remember Textbook, Charts, writing materials, calculator.	2.1 Verify Ohm's law. 2.2 Carry out experiments on series and parallel	· Teachers should ensure necessary precautions are taken during the experiments.	Resistor, capacitor, voltmeter, ammeter, ohmmeter, cable emf sources, thermometer, practical notebook, practical manual.

	Ohm's law. 2.6 Define resistively and conductivity of a conductor. 2.7 State the relationship between resistance of a conductor, its resistively, length and area. 2.8 Differentiate between series and parallel circuits. 2.9 Solve problems involving resistively and conductivity 2.10 Deduce the equivalent resistance of series and parallel circuits. 2.11 Explain Kirchoff's laws. 2.11 Explain the Superposition principles. 2.13 Solve problems involving series and	circuit with source. · Explain the flow of current. · Use diagrams to explain Ohms law. · Give some circuit with resistive components. · Verify Ohms laws. · Explain how to obtain resistively and conductivity from the formula R =ρ1/a. · Explain how to obtain resistivity from the formula R =ρ1/a. · Draw the circuit diagrams for series and parallel connections. · Explain the differences between the Kirchoff's		circuits. 2.3 Verify Kirchoffs law with d.c circuits. 2.4 Verify superposition principles. 2.5 Determine by experiment the temperature coefficient of resistance. 2.6 Verify by experiment the heating effect.		

	parallel circuits using Kirchoff's laws and superposition principles. 2.12 Define temperature coefficient of resistance. 2.15 Use the expression for resistance at temperature T°k and to calculate change in resistance. 2.16 See from 2.17 the change in resistance due to change in temperature. 2.17 Solve problems involving effect of temperature on resistance.	laws and superposition principles. Give examples. Explain the relationship between the temperature and resistance of a wire. · Show how to calculate a change in resistance when the temp changes. · Explain why there is a temperature change when the current flows through a wire. · Show a typical graph of resistance against temperature. Solve problems.				

	General Objective 3.0: Understand various types of energy and their inter-relationships					
Week	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**	**Specific Learning Outcome:**	**. Teacher Activities**	**Learning**
5-6	3.1 Explain various types of energy. 3.2 Explain the relationship between electrical, mechanical and thermal energy. 3.3 State S.I units of various types of energy in 3.2 3.4 State Joule's law. 3.5 Solve problems involving Joule's law.	. Explain the sources of various energy generations. · Show how they are related to electrical energy. Explain their units. · Solve problems.	Recommended textbooks, markerboard, writing materials, calculator, and marker.	3.1 Perform experiment to determine the d.c power. 3.1 Verify Joules' law 3.2 Perform experiment on charging and discharging of a capacitor.	· Teachers should ensure necessary precautions are taken during the experiment.	Resistors, capacitor, voltmeter, ammeter, ohmmeter, cable emf source, thermometer, practical notebook, practical manual.
	General Objective 4.0: Understand the concept of electrostatics, electric charge and capacitance of capacitors.					

Week	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	· Teacher Activities	Learning
7-8	4.1 Explain electric charge. 4.2 State its unit. 4.3 State Coulomb's law. 4.4 Solve problems involving coulomb's law. 4.5 Define electric field strength, electric flux density, permittivity, and relative permittivity, and field intensity, potential and electric flux. 4.6 Solve problems involving the terms in 4.5. 4.7 Define capacitance. 4.8 Derive an expression for the capacitance of parallel plate capacitors in terms of area, the distance between plates and permittivity of the	· Explain sources of electric charges and electrostatic charges. · Explain the mathematical formula for the electric charge, electrostatic charges. · Treat energy store in capacitor.	Recommended textbooks, markerboard, writing materials, calculator, and marker.	4.1 Perform experiment on charging and discharging of a capacitor.	· Teach the students how to perform the experiments with minimum error.	

	dielectric. 4.6 Derive an expression for the capacitance of parallel plate capacitors in terms of area, the distance between plates and permittivity of the dielectric. 4.10 Derive an expression for the capacitance of a capacitor with composite dielectrics 4.11 Derive an expression for the voltage distribution between series connected capacitors. 4.12 Deduce an expression for the equivalent capacitance for capacitors connected in series and in parallel. 4.13 Derive an expression					

	for the energy stored in a capacitor 4.14 Solve problems involving 4.8 to 4.12					
	General Objective: 5.0 State the general concept of magnetism and magnetic circuits.					
Week	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**
	5.1 Define magnetic flux, magnetic flux density magnetic motive force, magnetic field strength, reluctance, permeability of free space (magnetic constants), relative permeability. 5.2 State the symbols, units and	· State the general concept of magnetism and electromagnetism · The teacher is to derive formulae for field strength force etc. Show analogies between electrical and magnetic circuits. · Solve problems in the class.	· Magnetic Writing Board, textbooks, coil of conductor, magnetic materials, magnet, Calculator, writing materials.		· Ask students to perform the experiments with minimum error.	

	relationships of terms in 5.1 5.3 Draw the electrical equivalent of a magnetic circuit, with or without air-gap. 5.4 State analogies between electrical and magnetic circuits 5.5 Solve simple magnetic circuit problems 5.6 Distinguish between soft and hard magnetic materials.					
	General Objective: 6.0 Understand the concept of electromagnetism and electromagnetic induction.					
Week	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**
11-12	6.1 Explain the magnetic affect of electric current 6.2 Draw magnetic fields around straight	• The teacher to show right hand rule and explain the concept of electric field and	Marker Board, textbooks, coil of conductor, magnetic materials, magnet, and Calculator	6.1 Verify by experiment faraday's law of electro	• Conduct the experiments with students. • Arrange the practical session in such a way that	

	conductors, adjacent parallel conductors and solenoids. 6.3 Explain the force on a current carrying conductor in a magnetic field. 6.1 State the direction of the force in 6.4. 6.2 Derive the expression for the magnitude of the force in 6.4 (i.e. F = BIL Newton). 6.6 Explain the concept of electromagnetic induction. 6.6 State Faraday's Laws of electromagnetic induction. 6.8 State Lenz's law of Electromagnetic induction. 6.7 Derive the	electromagnetic Induction.	writing materials.	magnetic induction. 6.2 Perform experiment on Lenz's law of electro magnetic induction.	students participate actively in it	

	expressions for magnitude of e.m.f induced in a conductor or a coil. 6.10 Solve problems involving 6.6 to 6.10 above. 6.11 State the applications of electromagnetic induction.					
	General Objective: 7.0 Understand the concept of inductance and its applications					
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
13	7.1 Define self and mutual inductance. 7.2 State the symbols and units of the terms in 3.1 above. 7.3 State the expression for the equivalent inductance of inductances	· Explain mutual inductance and how to calculate various parameters. · Show with examples how energy stored is.	Recommended textbooks, writing materials, markerboard, marker, and calculator.	7.1 Determine by experiment the inductance of a coil. 7.2 Determine by experiment energy lost in an inductor.	· Conduct the experiments with students. · Arrange the practical session in such a way that students participate actively in it.	Basic Electricity, Measurement and Instrumentation Laboratory, Inductors, Power Supply Unit.

	connected in series and in parallel. 7.4 State the expression for the induced voltage across an inductor. 7.5 State the expression for inductance in coupled coils connected in series aiding or opposing. 7.1 Derive an expression for energy stored in an inductor. 7.7 Solve problem involving 3.3 to 3.6. 7.8 Describe using suitable diagram, the operation of the induction coiled in a car ignition system.					
	General Objective: 8.0 Understand the fundamentals of a.c. theory.					
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
14 -15	8.1 Describe the	• The teacher should explain	Recommended textbooks, writing	8.1 Demonstrate	• Show the students the	Basic Electricity, Measurement and

	production of an alternating e.m.f. by a rotating coil in a magnetic field. 8.2 Sketch a.c. waveforms both to scale and not to scale. 8.3 Define r.m.s, instantaneous, average, and peak values, period, and frequency of an a.c. waveform. 8.4 State relationship between instantaneous, and peak values of a sinusoidal wave. 8.5 Solve problems involving 4.2. to 4.4 8.6 Solve problems graphically on a.c circuits with different combinations of resistance, inductance	in detail the theory of alternating current and voltage. · Solve problems on a.c circuits.	materials, markerboard, marker, and calculator.	by experiment the relationship between the following: Frequency period and amplitude of sinusoidal wave. 8.2 Determine by experiment the Q factor of circuit containing R, L, and C in Series Parallel	necessary precautions to be taken during the experiment. · Provide well developed practical manuals for the experiments.	Instrumentation Laboratory, Resistors, Inductors, Capacitors, Ac circuits, Practical manual and Notebooks.

	and capacitance. 8.7 Differentiate between series and parallel resonance. 8.8 Explain phase lag or phase lead as applied to a.c. circuits. 8.9 Explain the difference between single-phase and three-phase supply. 8.10 State advantages and disadvantages of three phase supply over single phase supply.					

COMPETENCY: Students exposed to these activities should be able to weld, fabricate and do simple machining works.	**RECOMMENDED TEXT BOOK:** **Chapman**, Workshop Technology (Vols. 1-3) Edward Arnold, London.	**ASSESSMENT PROFILE:** Course Work = 20% Practical = 20% Test and quizzes = 20% Semester Examination = 40%

MECHANICAL ENGINEERING TECHNOLOGY COURSES

ADVANCED WORKSHOP TECHNOLOGY

	Department/ Programme: HIGHER **NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**	**Course Code: TRT**		**Contact Hours: 4hrs**
	Subject/Course ADVANCED WORKSHOP TECHNOLOGY			**Theoretical: 2hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: 2 hours /week*

General Objectives

1. **Understand the importance of heat processes**
2. **Know the properties and functions of steel tools**
3. **Understand the various metal cutting processes of metals observing safety precautions**
4. **Know various types of lathes and their functions**
5. **Understand the features, functions and uses of milling machines**
6. **Understand the features and functions of shaping machines**
7. **Understand the features and functions of a grinding machine.**
8. **Identify and repair chassis, frames, body and body styling**
9. **Identify and maintain vehicle dynamics and steering systems**
10. **Identify and maintain brake and transmission system**
11. **Identify and maintain Automotive Electrical system**
12. **Identify and maintain tires**

	Course: ADVANCED WORKSHOP TECHNOLOGY	**Course Code: TRT**		**Contact Hours: 4**
				Theoretical: 2 hours/week

	Year: *Semester:*	*Pre-requisite:*		*Practical: 2 hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
COURSE: Advanced Workshop Technology			**COURSE CODE: TRT**			**CONTACT HOURS: 20-2**
Course Specification: Theoretical and Practical Contents						
WEEK	**General Objective 1.0: Understand the importance of heat processes**					
	Theoretical Content			**Practical Content**		
	Specific Learning Outcomes	**Teacher's Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's Activities**	**Resources**
1 - 2	1.1 Distinguish between hand forging and drop forging.	Explain in details with aid of diagrams and adequate notes.	Whiteboard, Marker, Recommended Textbooks, Charts, Lesson plan, etc	1.1 Identify the tools used for heat processes. 1.2 Carry out forging, soldering and brazing operations and observe safety rules. 1.3 Perform the following operations: upsetting, drawing down, bending, punching, drifting and stamping and observe safety rules.	Demonstrate for the students to learn and allow them to practice till they become competent	Furnace, Blower, hammer, Tangs, sample material Quenching bath etc.

	General Objective 2.0: Know the properties and functions of steel tools			**General Objective 2.0: Understand heat treatment processes**		
	2.1 Define steel tools. 2.2 Distinguish among types of steel tools. 2.3 Explain the metallurgical	Explain in details with aid of diagrams and adequate notes.	Whiteboard, Marker, Recommended Textbooks, Charts,	2.1 Demonstrate heat treatment processes e.g. case hardening, annealing,	Demonstrate the processes in 2.1 and ask students to do	
3 - 4	properties of tool steels. 2.4 Describe the following heat treatment processes – case hardening, annealing normalizing and tempering.		Lesson plan, etc	tempering etc.	the same.	
	General Objective 3.0: Understand the various metal cutting processes of metals observing safety precautions			**General Objective 3.0: Practise metal cutting.**		
5	3.1Enumerate the various cutting methods and the safety precautions e.g. use of hacksaw, use electric hacksaw, flame cutting, oxy-arc and gorging, guillotine, chisel, and hand snips.	Explain in details with aid of diagrams and adequate notes.	Whiteboard, Marker, Recommended Textbooks, Charts, Lesson plan, etc	3.1 Carry out flame cutting, oxy-arc and gorging operations and observe safety precautions. 3.2 Carry out cutting by hacksaw and by mechanical hacksaw (power).	Demonstrate for the students to learn and allow them to practice till they become competent	Welding set, Welding machine, hacksaws, guillotine and hand tools.
	General Objective 4.0: Know various types of lathes and their functions			**General Objective 4.0: Practise mechanical cutting using lathes.**		

6	4.1 List the various types of lathe (such as capstan lathe, turret lathe, center lathe,) and their accessories. 4.2 Describe the features of the various types, of lathe machines. 4.3 Define feed and cutting speed as applied to machine tool work e.g., material to be cut, use of coolant and type of finish.	Explain in details with aid of diagrams and adequate notes. Explain in detail the feed and cutting speed of machine tool work.	Whiteboard, Marker, Recommended Textbooks, Charts, Lesson plan, etc	4.1 Select and use the appropriate cutting tools for efficient machining of various metals and observe safety rules. 4.2 Use job pieces to perform various lathe operations. 4.3 Identify any attachment necessary for 4.1. 4.4 Carry out the following operations on the lathe and observe safety rules: taper turning, step screw cutting, multi-start square thread cutting, etc.	Demonstrate for the students to learn and allow them to practice till they become competent	Lathe machines, cutting tools, measuring tools, cutting fluids, work pieces, goggles, and hand gloves.
	General Objective 5.0: Understand the features, functions and uses of milling machines			**General Objective 5.0: Demonstrate milling operations**		

7	5.1 Describe the main features of milling machines. 5.2 Outline the safety and operational precautions to be observed when milling. 5.3 Describe straddle and gang milling operations. 5.4 Describe the various features of the tool and cutter grinder. 5.5 List and state the uses of different types of milling cutters (arbor cutters, plain cutters, shank cutters and mills, T-slot side and mill cutter). 5.6 Describe the features and working principles	Explain in details with aid of diagrams and adequate notes.	Whiteboard, Marker, Recommended Textbooks, Charts, Lesson plan, etc	5.1 Perform the mounting of cutters on the milling machine. 5.2 Assemble a work piece and cutter holding device and attachment on a milling machine. 5.3 Identify cutters according to materials to be milled and type of milling operations with the safety precautions. 5.4 Determine cutting speeds and feeds for a given milling work. 5.5 Perform the up and down milling operations.	Demonstrate for the students to learn and allow them to practice till they become competent	Milling Machines, cutting fluids, milling cutters, work pieces, goggles, aprons/overalls, gloves, safety shoes, tool and cutter grinder

	of the dividing head.			5.6 Carry out various indexing methods on a miller, e.g., direct, simple, differential, angular indexing.		
	General Objective 6.0: Understand the features and functions of shaping machines			**General Objective 6.0: Demonstrate activities on shaping machines.**		
8	6.1 Describe the main features of shaping machines. 6.2 List the advantages of a swan-necked tool on a shaping machine.	Explain in details with aid of diagrams and adequate notes.	Whiteboard, Marker, Recommended Textbooks, Charts, Lesson plan, etc	6.1 Identify appropriate shaping tools for different surface forms. 6.2 Perform the setting up of work piece on the shaping machine. 6.3 Perform the adjusting of the length and position of the stroke of the shaping machine. 6.4 Carry out the setting of a clapper box for a given operation. 6.5 Carry out slotting, surface planing, and keyway cutting on a shaping machine.	Demonstrate for the students to learn and allow them to practice till they become competent	Shaping machine, shaping tools, work pieces, cutting fluids goggles, gloves, apron/overalls and safety shoes, parallels.
	General Objectives 7.0: Understand the features and functions of a grinding machine.			**General Objective 7.0: Practise activities on the grinding machine.**		

9	7.1 Describe the main features of grinding machine.		Whiteboard, recommended texts, charts, etc.	7.1Identify the main features of grinding machines in 7.1. 7.2 Carry out the grinding of job pieces on the machine and observe safety rules. 7.3 Identify the wheels for grinding different types of materials. 7.4 Perform the following operations. - surface grinding - taper grinding - tool and cutter grinding - centre-less grinding - gauge grinding - Wheel testing and mounting - Wheel balancing and alignment - Wheel dressing and truing.	Demonstrate for the students to learn and allow them to practice till they become competent	Pedestal grinding machine, goggles, hand gloves, aprons, safety shoes, cylindrical grinding machine, and surface grinders.

Week	General Objective 8.0: Identify and repair chais frames, body and body styling					
	THEORETICAL CONTENT			PRACTICAL CONTENT		
	Specific Learning Outcome:	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**
10				8.1Identify the construction of a vehicle chasis 8.2Carryout welding, etc of broken chasis frames, fitting of chasis frames. 8.3Identify and dismantle body component parts to locate fixing points, joint, locks	Demonstrate activities 8.1 to 8.3 for the students to learn and ask them to perform all the activities	Life vehicles 2nos Vehicle pit 2nos Car lift 1no 1.3, 15No Electric Arc welding kit. Welding electrodes
	General Objective 9.0: Identify and maintain vehicle dynamics and steering systems					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
11				9.1Identify vehicle suspension system such as civil spring, leaf springs, etc. 9.2Dismantle these suspension systems, identify the components	Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to carryout the activities. Assess the students	Complete tool box 5Nos coil spring leaf springs 5nos 5nos torsion bar Hydro-pneumatic suspension unit 5nos. Different steering assemblies Rack and pinion Power assisted steering assembly.

				and assemble them. 9.3Dismantle steering system units and identify the components and assemble them.		
Week	**General Objective 10: Identify and maintain brake and transmission system**					
	Specific Learning Outcome:	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**
12				10.1Identify brake for different types of vehicles 10.2Dismantle, identify components of brake system and assemble them. 10.3Carryout maintenance of brake system 10.4Perform Brake bleeding 10.5Dismantle clutch and gear, identify all components and assemble them. 10.6Carryout	Demonstrate activities 10.1 to 10.7 for the students to learn and ask them to carryout all the activities. Assess the students.	Drum/disc brake assemblies Master cyclinder and types Air brake system and bed Brake test equipment Differential gears Half shafts assemblies

				an overhaul of automatic gear box. 10.7Remove and replace universal joints Carry out an overhaul of final drive system and identify differential assembly, crown wheel, pinion, differential cage.		
	General Objective 11: Identify and maintain Automotive Electrical system					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
13-14				11.1Dismantle starter motor to identify armature, commutator, brushes and mounting. Stator winding, solenoid and Bendix drive and assemble them. 11.2Carryout overhaul of	Demonstrates activities 11.1 to 11.6 for the students to learn and ask them to perform all the activities.	Alternator assembly Hydrometer Battery charger and connecting cables Ignition system components (10nos.) Sparks plugs. (20nos) Start motor assembly Switch/relay unit (10Nos.)

				alternator 11.3Prepare acid for filling battery and connect battery to battery charger. 11.4Identify ignition system components – ignition coil, distributor, capacitor, contact braker set, high tension cables. 11.5Trouble shoot and repair faults in system. 11.6Overhaul wiper systems.		
Week	**General Objective 12: Identify and maintain tires**					
	Specific Learning Outcome:	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**
15				12.1Identify different types for different vehicles 12.2Carryout road wheel assembly balancing, and alignment 12.3Carryout	Demonstrate activities 12.1 to 12.3 for the students to learn and ask them to carryout all the activities. Assess the students	Various tire tires Balancing and alignment machine Air compressor Tire patch tire pressure gauge

				quick patch, and heat application		

Assessment: Coursework/ Assignments %; Course test: 20 %; Practical: 20%; Examination 60 %

Recommended Textbooks & References:

MECHANICAL ENGINEERINGSCIENCE

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: MEC 111**		**Contact Hours: 3**
	Subject/Course: MECHANICAL ENGINEERING SCIENCE			**Theoretical:1 hours/week**
	Year: 1 Semester: 2	***Pre-requisite:***		***Practical: 2 hours /week***

General Objectives

1. Understand the concept and effect of forces and their moments.

2. **Understand the effect of Friction and the law governing it.**

4. Understand Linear and Angular motions of bodies.

5. Understand curvilinear motion of bodies

6. Understand Momentum of Bodies

7. Understand the concept of Work, Energy and Power

8. Understand General principle of operation of simple machines.

9. **Know simple harmonic motion.**

	Course: MECHANICAL ENGINEERING SCIENCE	**Course Code: MEC 111**		**Contact Hours: 3**
				Theoretical: 1 hours/week
	Year: 1 Semester:1	*Pre-requisite:*		*Practical: 2 hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
COURSE: MECHANICAL ENGINEERING SCIENCE		**Course Code: MEC 111**		**Contact Hours 1-0-2 Hrs/Wk**		
Course Specification: THEORETICAL CONTENT				**PRACTICAL CONTENT**		
	General Objective 1.0: Understand the concept and effect of forces and their moments.			**General Objective1.0: Demonstrate the concept and effect of forces and their movements.**		
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
1 – 2	1.1 Define force 1.2 Explain how to construct parallelogram of force. 1.3 Calculate the resultant of a system of two forces 1.4 State the principle of	· 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' assignments.	Recommended textbook, markerboard, duster, marker, Lecture notes, etc.	1.1 Construct parallelogram of force. 1.2 Draw triangle of forces 1.3 Draw polygon of forces 1.4 Verify Lami's theorem using a force board 1.5 Verify the parallelogram law of forces	· Demonstrate activities 1.1 to 1.5 for the students to learn and ask them to carry out all the activities	Drawing materials/instruments.

	triangle of force 1.5 Resolve forces into Components. 1.6 Resolve a force into force and couple 1.7 State the conditions for the equilibrium of co-planar forces 1.8 Define moment of a Force. 1.9 State the principles of moments. 1.10 Solve problems related to 2.1 to 2.9 above.					
	General Objective: 2.0 Understand the effect of Friction and the law governing it.			**General Objective 2.0: Determine the effect of Friction.**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**

3 -4	2.1 Define friction 2.2 State advantages and disadvantages of friction. 2.3 Define coefficient of Friction. 2.4 Define limiting angle of friction. 2.5 Define angle of Repose. 2.1 Solve problems related to 3.1 to 3.5.	· Explain in details the principles and effects of friction and the law governing it. · Guide the students to solve problems relating to friction.	Recommended textbook, markerboard, duster, marker, Lecture notes, etc.	2.1 Determine the co-efficient of friction by means of an inclined plane.	· Demonstrate activity 3.1 for the students to learn and ask them to carry out the activity. ·	Specimens of mosses and inclined plain set-up. Protractor, etc.
Week	**General Objective 3.0: Understand Linear and Angular motions of bodies.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

5- 6	3.1 Define displacement, speed, distance, velocity and acceleration. 3.2 State units of displacement, speed, distance, velocity and acceleration. 3.3 Derive the relationship between displacement, velocity and acceleration. 3.4 Draw velocity time graph. 3.5 Add velocities vector ally. 3.6 Define relative velocity. 3.7 Solve simple problems related to 1.1 to 1.6 above.	• Explain in details the concepts of linear motion of bodies. • Guide the students to draw velocity - time graph and solve problems relating to displacement, velocity and acceleration. • Assess students' assignments.	Marker, markerboard, Duster, Recommended textbooks, Lecture notes, Graph sheets, etc.			

	3.8 Define angular motion of a body in a circle. 3.9 Derive the relationship between angular velocity and acceleration. 3.10 Draw angular velocity- time graph.					

Week	General Objective4.0: Understand curvilinear motion of bodies.			General Objective 4.0: Determine Curvilinear motion of bodies.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
7	4.1 Develop the	• Explain in details	Marker, markerboard,	4.1 Show that centrifugal	• Illustrate 4.1 to	Practical guide, Centrifugal

	relationship between angular and linear motions. 4.2 Define circular motion. 4.3 Explain centrifugal acceleration and centrifugal force. 4.4 Develop expressions for centripetal and centrifugal forces. 4.5 Give examples of centrifugal effects e.g. Planetary motion, Conical pendulum, etc.	the concept of curvilinear motion of bodies. · Guide students to develop expressions for centripetal and centrifugal forces and solve problems on them.	Duster, Recommended textbooks, Lecture notes, etc.	force varies with mass, speed of rotation, and the distance of the mass from the centre of rotation using centrifugal force apparatus. 4.2 Verify the equation of motion using Fletcher's trolley.	4.2 and ask the students to perform experiments. · Assess the students' reports.	apparatus. Fletcher's trolley Weights
Week	**General Objective 5.0: Understand Momentum of Bodies.**			**General Objective 5.0: Determine Momentum of Bodies**.		
	Specific Learning	**Teachers Activities**	**Resources**	**Specific Learning**	**Teachers Activities**	**Resources**

	Outcome			**Outcome**		
8-9	5.1 Define Mass and Weight of a body. 5.2 State Newton's Laws of motion. 5.3 Define Impulse and Momentum. 5.4 State the Law of Conservation of Momentum. 5.5 Define Angular Momentum. 5.6 Define Radius of Gyration. 5.7 Explain Moment of inertia. 5.8 Solve problems related to 5.1 to 5.7.	· Describe in details the concepts and principles of momentum. · Guide the students to solve problems relating to momentum. · Assess students' assignments.	Marker, markerboard, Duster, Recommended textbooks, Lecture notes, etc.	5.1 Determine moment of inertia. 5.2 Verify the law of conservation of moment on Fletcher's trolley.	· Illustrate activities 5.1 to 5.2 and ask the students to perform experiments. · Assess the students' reports.	Recommended apparatus. Fletcher's trolley.
Week	**General Objective 6.0: Understand the concept of Work, Energy and Power**			**General Objective 6.0: Determine Forces and Torque of a system.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

10-11	6.1 Define Work, Energy and Power. 6.2 State the units of work, energy and power. 6.3 Develop expressions for Work, Energy and Power. 6.4 Define Torque and work done by Torque. 6.5 Explain Tractive Force and driving Torque of a system. 6.6 Differentiate between Kinetic Energy and Potential Energy. 6.7 Explain Kinetic Energy of rotating bodies.	· Explain in details with the concepts of work, energy, torque and power. · Guide the students to solve problems on work, energy, power and torque. · Assess the students' graded assignments.	Marker, markerboard duster, Recommended textbooks, Lecture notes, etc. Marker, Blackboard.	6.1 Determine tractive force and driving torque of a system. 6.2 Determine kinetic energy of rotation.	· Demonstrate to the students the activities in 6.1 to 6.2 and ask the students to perform the experiments. · Assess the students' reports.	

	6.8 Explain Mechanical Efficiency in power transmission. 6.9 Explain power transmission by flat belts, spur gearing and worm gearing.					
Week	**General Objective 7.0: Understand General principle of operation of simple machines.**			**General Objective 7.0: Determine the practical principle of operation of simple machines**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
12-13	7.1 Define simple machine. 7.2 Give examples e.g. Lever, Pulley, Screw Jack, etc. 7.3 Explain the operations of 5.2 above. 7.4 Define (i) Mechanical	· Explain in details the features, types and principle of operation of simple machines. · Guide the students to derive the expression for the Mechanical Advantage, Velocity Ratio and Efficiency of wheel, pulley and screw jack and	Marker, markerboard, Duster, Recommended textbooks, Lecture notes, etc.	7.1 Determine the velocity ratio, mechanical advantage and mechanical efficiency of a screw jack. 7.2 Determine the velocity ratio and efficiency of simple pulley system.	· Demonstrate the activities in 7.1 and 7.2, and ask the students to perform the experiments.	Practical guide, screw jack and pulley system.

	Advantage (ii) Velocity Ratio (iii) Mechanical Efficiency 7.5 Develop the relationship for Mechanical Advantage, Velocity Ratio and Efficiency of a wheel, pulley and screw jack 7.2 Solve simple problems related to 5.1 to 5.5 above.	solve problems on them.				
Week	**General Objective 8.0: Know simple harmonic motion.**			**General Objective 8.0: Demonstrate simple harmonic motion.**		
		·			·	
14-15	8.1 Describe periodic motion 8.2 Describe period, frequency and	· Explain in details the features and principles of Simple Harmonic Motion (SHM). · Guide the students to derive	Marker, Blackboard, Duster, Recommended textbooks, Lecture notes, etc.	8.1 Determine experimentally the period and frequency of oscillation of a	· Demonstrate the activity in 8.1 and ask the students to carry out experiment.. · Assess the students' reports.	Simple Pendulum

	amplitude in simple harmonic motion. 8.3 Develop expressions for 6.3 above. 8.4 Analyse the motion of a simple pendulum. 8.5 Solve problems related to the above.	expression for period, frequency and amplitude of SHM and solve problems on them. • Assess the students' assignments.		simple harmonic motion.		
	ASSESSMENT PROFILE: Course Work = 20% Practical = 20% Test and quizzes = 20% Semester Examination = 40%		**COMPETENCY:** Students exposed to these activities should be able to explain, compute and analyse forces in Mechanical Systems.		RECOMMENDED TEXTBOOK **Hannah & Hiller,** Mechanical Engineering Science.	

SAFETYAND COMFORT SYSTEM

	Department/ Programme: HIGHER **NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**	**Course Code: MCE 305**		**Contact Hours: 2**
	Subject/Course: SAFETY AND COMFORT SYSTEM			**Theoretical: hours/week**
	Year: *Semester:*	*Pre-requisite:*		*Practical: hours /week*

General Objectives
1. Differentiate between the Various Types of Thermometers and Pressure Gauges

2. Describe the Effect of Temperature, Pressure and Volume on Refrigeration and Air Conditioning Systems
3. Discuss the Principle of Conversion of Electrical Energy to Heat Energy
4. Describe the Three States of Matter
5. Describe the Refrigeration Cycle and Principles of Air Conditioning
6. Describe the Various Types of .Compressors and Their Working Principles.
7. Understand refrigerant flow controls and functions
8. Describe the charging of refrigeration systems with refrigerants
9. Understand the Lubrication of a Refrigeration System

	Course: SAFETY AND COMFORT SYSTEM	**Course Code: MCE 305**		**Contact Hours:**
				Theoretical: hours/week
	Year: Semester:	*Pre-requisite:*		*Practical: hours /week*
	Theoretical Content		*Practical Content*	

PROGRAMME: HIGHER NATIONAL DIPLOMA TRANSPORT TECHNOLOGY		
COURSE: SAFETY AND COMFORT SYSTEM	**Course Code: MCE 305**	**Contact Hours: 1-0-2 Hrs/Wk**
COURSE SPECIFICATION: THEORETICAL CONTENTS	**PRACTICAL CONTENT**	

Week	General Objective: 1.0 Differentiate between the Various Types Of Thermometers And Pressure Gauges					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1 – 2	1.1 Define temperature and pressure. 1.2 Identify the various types of thermometers and pressure gauges used in refrigeration and air conditioning. 1.3 Describe various Temperature. measuring scales. 1.3 Plot the various temperature scale on a graph and convert one temperature scale to another .	· Describe temperature measuring instruments. · Guide the students to measure temperature using various thermometers. · Explain the conversion of one temperature scale to another. · Guide the students to measured the pressure using pressure gauges	Marker, whiteboard Recommended textbooks, temperature and pressure gauges	1.1 Read common thermometer and pressure gauges.	· Explain the calibration of thermometer and pressure gauge to students. · Demonstrate the procedure of disassembling and assembling of air conditioner and a refrigerator. · Draw up a maintenance schedule of an air conditioner and refrigerator. · Guide the students into effective use of hand tools used in the maintenance of the above.	Marker, whiteboard recommended textbooks, temperature and pressure gauges Life size refrigerator and air conditioner Tool box, manual

	General Objective: 2.0 Describe The Effect Of Temperature, Pressure And Volume On Refrigeration And Air Conditioning Systems					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
3	2.1 State the relevant gas laws. 2.2 Carryout calculation using the various gas laws formulae 2.3 Explain the various gas laws and derive their standard equations.	• Derive the pressure/ volume relationship and carryout some exercises.	Marker, Whiteboard Recommended Textbooks Teaching models	2.1 Disassemble and assemble a typical room air conditioning components		
	General Objective: 3.0 Discuss The Principle Of Conversion Of Electrical Energy To Heat Energy					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	3.1 Outline the units of power and	3 Explain power and heat. 4 Ask the students to distinguish between power	Marker, whiteboard recommended textbooks, steam	3.1 Disassemble and assemble a typical		

4-5	heat. 3.2 Calculate the power used and heat generated by the compressor using the pressure and enthalpy chart.	and heat. 5 Carryout some exercises.	table etc.	refrigeration system.		
	General Objective: 4.0 Describe The Three States Of Matter					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
6	4.1 Define matter. 4.2 State the three state of matter 4.2 Differentiate between the three states of matter.	· Explain matter. · Distinguish between the three states of matter.	Marker, whiteboard recommended textbooks etc.	3.2 Carryout maintenance on flow control elements		
	General Objective: 5.0 Describe The Refrigeration Cycle And Principles Of Air Conditioning					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
7-9	5.1 Define refrigeration	· Explain the characteristic	Marker, whiteboard	· Carryout trouble shooting and		

	and show refrigeration cycles. 5.2 Define the term Refrigerant. 5.3 Describe the conditions of refrigerant in a refrigeration cycle. 5.4 Define the term air conditioning. 5.5 Explain the principles of air conditioning. 5.3 Use the Psychometer and psychometric chart to determine moist air properties. 5.4 List parts of air conditioner.	desire in a refrigerant. Ask the students to: · Identify the characteristic of a refrigerant . · Explain the refrigerant numbering system. · State the uses of refrigerants. · Explain the effects of moisture on refrigerants. · Distinguish between primary and secondary refrigerants · State the functions of the components of Air-Conditioners. · State the applications of Air conditioners. · Guide the students through the use of psychometer and psychometric	recommended textbooks, Psychometer and Psychometric chart etc.	maintenance of compressors		

		chart.				
	General Objective 6.0: Describe the Various Types of .Compressors ands Their Working Principles.					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
10-11	6.1 Define the term compression. 6.2 List the various types of compressors. 6.3 Explain the construction and functions of a compressor. 6.4 Differentiate between the various types of compressors A. Classify them by shapes, size and physical features. B. State their appropriate uses.	· Explain the operation of a compressor. · State the advantages and disadvantages of each type of compressor. · Ask the students to explain the difference between open hermetic and semi hermetic compressors. · Guide the students to select a compressor required for a given application using a given design data. · Perform calculations of a power requirement of a compressor .	Marker, whiteboard recommended textbooks, instructional drawing of a compressor, life compressor.			

	General Objective: 7.0 Understand Refrigerant Flow Controls And Functions					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
12	7.1 Identify the various refrigerant flow controls. 7.2 Explain the principles of operation of a refrigerant flow controls. 7.1 State the functions of the various types of refrigerant flow controls.	· Explain the need for the flow controls. · Ask the students to state applications of the flow controls listed in 7.1. · List the factors which guide the selections of flow controls in 7.1. · Carry out maintenance of flow control.	Marker, whiteboard recommended textbooks, samples of flow control elements.			
	General Objective: 8.0 Describe the charging of refrigeration systems with refrigerants					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	8.1 Explain the charging principles	· List the tools commonly used in the charging of refrigeration	Marker, whiteboard recommended textbooks,			

13	of the refrigeration systems with refrigerants. 8.2 Identify point of leakages and state how to rectify them.	systems. · State the precautions taken when handling toxic and explosive refrigerants.	Typical hand tools			
	General Objective 9.0: Understand The Lubrication Of A Refrigeration System.					
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
14 - 15	9.1 State the types and functions of lubricating oil in a refrigeration system. 9.2 Explain the importance of lubricating oil in a refrigeration system. 9.1 State the properties of lubricants used	· Explain lubrication and its effects on refrigeration systems. · Guide the students in the choice of lubricants to be used in refrigeration systems.	Marker, whiteboard recommended textbooks, Typical hand tools, lubricants.			

	in refrigeration system.					

Competency:

1. Explain in writing the functions and operations of safety and comfort systems.
2. Read common thermometer and pressure gauges.
3. Disassemble typical vehicle air conditioning and refrigeration system.
4. Carry out maintenance operations on air-conditioning and refrigeration systems.
5. Carry out vehicle body interior trimming fittings.

Assessment: Course work 20%, Course Tests 20%, Practicals 20%, Examination 40%.

References: Fundamentals of Motor Vehicle Technology

Motor Vehicle Automotive Encyclopedia

AUTOMOTIVE HYDRAULIC AND PNEUMATICS

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY						
COURSE: AUTOMOTIVE HYDRAULIC AND PNEUMATICS			**Course Code: MCE 112**		**Contact Hours: 2-0-2 Hrs/Wk**	
Course Specification: Theoretical Content			**PRACTICAL CONTENT**			
Week	**General Objective: 1.0: Understand the classifications, types, and characteristics properties.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
1	1.1 Define fluids. 1.2 List different types of fluids. 1.3 Differentiate between the fluids listed in 1.2. 1.4 Describe fluid properties. 1.5 State Newton's law of viscosity. 1.6 Give application	• Explain the following fluid properties: i. Pressure ii. Relative density iii. Specific density iv. Specific volume v. Compressibility vi. Viscosity vii. Vapour pressure viii. Surface tension ix. Capillary x. Cohesion and adhesion.	Marker Whiteboard Textbook Conference papers Journals	1.1 Demonstrate the use of : i. Power unit ii. Relief Valve iii. 2-way flow control valve iv. manometers v. Shut-off valve		

	of each type of fluids mentioned.					
	General Objective: 2.0: Analyze the concept of pressure and the principle of pressure measurement.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
2-3	2.1 Derive an expression for the pressure at a point in a fluid (i.e weight and depth). 2.2 Explain the working of the following instrument for pressure measurement: a. Barometer b. Piezometer c. U-tube manometer d. Bourdon gauge e. Aneroid barmeter	· Explain how a fluid can exert pressure due to its weight. · Explain why the pressure in a fluid varies with depth. · Calibrate the bourdon pressure gauge. · Solve simple problems related to pressure measurement.	Marker, Whiteboard Duster Recommended Textbooks Instructional Drawings Lecture notes etc.	2.1 Demonstrate the application of hydraulic & pneumatic equipment/ tools.		

	2.3 Derive an expression for the total thrust acting on plane vertical surface submerged in a liquid. 2.4 Identify the point where the resultant thrust acts. 2.5 State parallel axes theorem.					
	General Objective: 3.0 Understand Archimedes principles.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
4	3.1 State Archimedes principles. 3.2 Define (I) buoyant force (ii) centre of buoyancy. 3.3 Explain the working of a hydrometer. 3.4 Explain the three	· Explain Archimedes principles. · Apply Archimedes principles to determine the density of a substance. · Use hydrometer to determine the relative density of liquids.	Marker Whiteboard Duster Recommended Textbooks Lecture notes etc.			

	equilibrium state of floating objects viz: (i) stable (ii) unstable (iii) neutral. 3.5 Explain what is mean by metacentric height of a floating object. 3.6 Derive an expression for metacentric height of a floating object.	· Solve problems associated with floating objects. · Calibrate a hydrometer.				
	General Objective: 4.0 Analyze the concept of thermal efficiency..					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
6	4.1 Define thermal efficiency. 4.2 Compose the thermal efficiencies of common heat energy plants e.g.	· Explain thermal efficiency. · Guide the student to calculate thermal efficiencies. · Solve problems involving the calculation of thermal efficiencies.	Marker Whiteboard Duster Recommended Textbooks Lecture notes etc.			

	a. The newcome steam engine b. The automobile engine. 4.3 Define a heat engine.					
	General Objective: 5.0 Explain ideal gas laws.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
7	5.1 Define: · Boyle's law · Charles's law · Pressure law · Ideal gas law 5..2 Distinguish between real and ideal gas.	· Explain the ideal gas laws. · Solve problems involving the gas law.	Marker Whiteboard Duster Recommended Textbooks Lecture notes etc.			
	General Objective: 6.0 Classify fuels and their combustion characteristics.					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
8	6.1 Define	· Explain exothermic	Marker			

exothermic and endothermic reactions. 6.2 Define fuels. 6.3 Identify hydrocarbon fuels 6.4 Describe the formation of fossil fuels. 6.5 State the composition of natural gas. Define gross and net calorific values of fuels. Compute density of gases at S.T.P. 6.8 Describe the chemical changes which takes place during the combustion of: · Carbon	and endothermic reactions. · Classify fuels into gaseous, liquid and solid. · Describe the fundamental properties of fossil fuels. · List the application of fossil fuels. · Explain complete, incomplete and stoichiometric combustion. · Explain air-fuel ratio and mixture strength of combustion. · Explain the causes and effects of incomplete combustion.	Whiteboard Duster Recommended Textbooks Lecture notes etc.			

· Hydrogen · Hydrocarbons.					

Competency:

1. Demonstrate the use of workshop hydraulic and pneumatic tools.
2. Calibrate the bourdon pressure gauge
3. Solve simple problems on, pressure measurement
4. Calibrate a hydrometer

Assessment: Course work 20%: Course Test 20%: Examination 60%

METROLOGY

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code:** MEC 411		**Contact Hours: 3HRS/Week**
	Subject/Course: METROLOGY			**Theoretical: hours/week**
	Year: 2 Semester: 3RD	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Know the fundamentals of measurement
2. Understand the types and sources of errors
3. Understand the constructional details of simple measuring instruments
4. Understand the concept of quality, the importance and organization of quality control
5. Understand the control of quality through specification of dimensions of machines elements and sub-assembly (at design stage)
6. Understand the control of quality at the production and planning stages. 1
7. Know how to measure and identify the accuracy grade of a thread.
8. Know the principles and applications of comparators
9. Understand the principles of angular measurement
10. Understand the measurement of gears and identify their accuracy grade
11. Understand the principles of simple interferometric measurement
12. Know the purpose and types of alignment tests for common types of machine tools

	Course: METROLOGY	**Course Code: MEC 411**			**Contact Hours: 3HRS/Week**	
					Theoretical: 1 hours/week	
	Year: 2 Semester: 3RD	*Pre-requisite:*			*Practical: 2 hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Know the fundamentals of measurement					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	1.1 Describe workshop standards of length 1.2 List the sub-divisions of standard of length 1.3 Discuss the sub-divisions in 1.1	▪ Ask students to explain the fundamentals of measurement and give the standards of length	▪ Comparator, Limit gauges, Steel rule , Dynamometer, ▪ Thermometer, Thermocouple ▪ Pyrometer, marker, markerboard, Vernier caliper, ▪ Beuch testing centres	1.1 Perform a gauging test on a thread. 1.2 Measure the core and outer diameter on a thread. 1.3 Measure pitch on a thread.	▪ Ask students to list types of gauges and describe standards used in thread gauge tolerance Ask students to carryout a gauging	▪ Marker ▪ Marker board ▪ Pitch measuring machine ▪ Thread micrometer ▪ Standard Ring gauges, Bolts and Nuts

					test on a thread and also measure the core outer diameter and pitch of the thread	
	General Objective 2: **Understand the types and sources of errors**					
1	2.1 Describe the types of errors commonly found in engineering measurement 2.2 Identify sources of errors in measurement such as equipment errors, operational interference, installation. 2.3 Explain means of over-coming errors mentioned in 2.1 above. 2.4 Describe (drunken thread).	▪ Ask students to explain common sources of error and how to over-come them				
	General Objective 3: **Understand the constructional details of simple measuring instruments**					
2 3	3.1 Explain the principles construction and operation of the following (a) dynamometer (b) bourdon tube manometers (c) thermometer, pyrometer, thermocouple etc.	▪ Ask students to draw and explain the details of simple measuring instruments ▪ Ask students to explain with aid of diagrams the operation of dynamometer bourdon tube manometer etc.		1.4 Compare the measured parameters of a thread with standard values. 1.5 Using ring, snap and	▪ Ask students to compare the result from above	.

				plug thread gauges to carry out a gauging process on bolts and nuts 1.6 Compare the measured parameters of a thread with standard values. 1.7 Using ring, snap and plug thread gauges to carry out a gauging process on bolts and nuts	to standard values. Ask students to carryout gauging process on bolt and nuts using ring, snap and plug thread gauges	
	General Objective 4: **Understand the concept of quality, the importance and organization of quality control**					
4	4.1 Explain quality control and related terminologies: durability, reliability interchangeability 4.2 Explain the measurement/testing of the parameters in 1.1. 4.3 State the scope and objectives of quality control and explain the work of the quality control department in a firm.	▪ Ask students to: ▪ Explain quality control using the right terms. ▪ Ask students to describe how to quantify quality control ▪ Ask students to list the work of the quality control department	▪ Marker, markerboard, Lecture note	1.8 Gauge holes and classify them into limited tolerance groups using a pneumatic comparator.	▪ Ask students to compare the result from	

	4.4 List the stages of the production process and explain the influence of each on the overall quality of a product. 4.5 List the factors that affect the quality of a product 4.6 Explain the relationship between quality and cost (of a product)	▪ Ask students to explain how production process affects quality and relate this to cost.		1.9 Use sine bars, slip gauges and precision rollers to carry out angular measurement of an object	above to standard values. ▪ Ask students to carryout gauging process on bolt and nuts using ring, snap and plug thread gauges. ▪ Ask students to set up comparators for gauging shafts and	

					holes.	
	General Objective 5: Understand the control of quality through specification of dimensions of machines elements and sub-assembly (at design stage)					
5 6	5.1 State importance of interchangeability of machine parts and elements with respect to the quality of a product. 5.2 State the necessity of imposition of tolerance on the size of elements. 5.3 Present graphically the position of tolerance in relation to "zero line" for various fundamental deviations. 5.4 State the meaning of "basic hole" and "basic shaft" and present their tolerance zones in graphical form. 5.5 Explain the notion of fit between two mating parts (shaft and hole) 5.6 Calculate the maximum and minimum clearance and interference for various fits.	▪ Ask students to explain specifications as it relate to dimensioning of machine elements and sub-assemblies. ▪ Ask students to give appropriate tolerance on certain sizes of machine elements. ▪ Ask students to explain `basic hole' and `basic shaft' and show their tolerances zones graphically ▪ Ask students to draw and explain the notations for fit and show it on two mating parts (shaft and hole)	▪ Marker Marker board	Use monochromatic light source, optical flats, optical parallels, slip gauge set and interferometric outfit to perform the following experiments: (i) measure the error of flatness of slip gauges, micrometer measuring faces and other flat reflecting surfaces. (ii) Measure the error of parallelism of micrometer measuring faces (iii) measuring small deviation in size and small dimensions (iv)	▪ Ask students to perform gauging operations with the three comparators ▪ Ask students to explain the standard proportion of gears. ▪ Ask students to measure involut	

				calibrate the micrometric head	e form, tooth line errors and base pitch error of a gear.	
7	5.1 Distinguish between three types of fits and give their examples in graphical form. 5.2 Explain the different between "Hole Basic" and "Shaft basis" fits 5.3 Present graphically 2.8 5.4 Outline the main features of the ISO system for limits and fits. 5.5 Explain why and on what principles that vast number of possible ways to produce fits (combination of all holes with each shaft) has been constrained in practical standards to some limited number of fits. 5.6 Explain when "Hole Basic" fits are preferred to "Shaft Basic" fits and vice-versa. 5.7 Define the meaning of term "Dimensional Chain" 5.8 Explain the linear difference between constructional and technological dimensional chains. 5.9 Perform calculations on tolerated dimensions.	▪ Ask students to explain fits and differentiate between Hole basic and Shaft basic fits graphically. ▪ Ask students to illustrate the ISO system method for describing limits and fits. ▪ Ask students to explain standards of fits. ▪ Ask students to give examples of when Hole basic is preferred to Shaft basic and vice-versa. ▪ Ask students to differentiate between constructional and technological dimensional chains. ▪ Ask students to carry out some calculations of		1.10 Use the involute testing machine to carry out the measurement of the involute form; tooth line errors and base pitch error of a gear.	▪ Ask students to prepare reports on the experiments of 8.6	

	Calculate dimensional chains.	dimensional chains.				
	General Objective 6: Understand the control of quality at the production and planning stages. 1					
7	1.1 Distinguish between measurable characteristics (variables) and non-measurable (attributes) of a product. 1.2 Explain automatic inspection and statistical method of control using charts 1.3 State the advantages and disadvantages of the inspection methods in 3.1. 1.4 Select means of inspection measuring instruments, gauging devices etc. 1.5 Explain the general theory of control charts used in standards (e.g. BS 2564: 1969) 1.6 Construct control charts (graphs) for sample average and sample range to monitor process variation. 1.7 Construct fraction defective and number defective control charts. 1.8 Interpret information derived from the charts in 3.5 and 3.6 1.9 Explain the effect of the quality of machine tools, cutting tools, jigs and fixtures on the quality of the items produced	▪ Ask students to differentiate between measurable and non-measurable characteristics of a product. ▪ Ask students to illustrate the difference between inspection and statistical methods of control. ▪ Ask students to give advantages and disadvantages of inspection method. ▪ Ask students to explain control charts using BS 2564: 1969 and ISO Ask students to construct control charts for monitoring process variation. ▪ Ask students to construct fraction detective and number defective control charts and interpret the information. ▪ Ask students to explain effect of quality of machine tools to quality	▪ Marker ▪ Marker board			

		of products produced.				
	General Objective 7.0: Know how to measure and identify the accuracy grade of a thread.					
8	7.1 List the type of thread gauges 7.2 Describe standards for thread gauges tolerances 7.3 Explain setting and adjustable and indicating thread gauges of both external and internal type. 7.4 Perform a gauging test on a thread 7.5 Measure the core and outer diameter on a thread. 7.6 Measure pitch on a thread. 7.7 Compare the measured parameters of a thread with standard values. 7.8 Using ring, snap and plug thread gauges to carry out a gauging process on bolts and nuts.	• Ask students to list types of gauges and describe standards used in thread gauge tolerance. • Ask students to carryout a gauging test on a thread and also measure the core outer diameter and pitch of the thread. • Ask students to compare the result from above to standard values. • Ask students to carryout gauging process on bolt and nuts using ring, snap and plug thread gauges.	• Marker • Marker board • Pitch measuring machine • Thread micrometer • Standard Ring gauges, • Bolts and Nuts.	1.11 Use the involute testing machine to carry out the measurement of the involute form; tooth line errors and base pitch error of a gear.	▪ Ask students to prepare reports on the experiments of 8.6	
	General Objective 8.0: Know the principles and applications of comparators					
9	8.1 Differentiate comparative measurement from direct measurement 8.2 List the essential elements of a	▪ Ask students to differentiate between comparative measurement from	Marker, markerboard	Conduct practical test on the common machine tools,	▪ Ask students to illustra	

	comparator. 8.3 Explain the functions of each element as stated in 5.2. 8.1 Explain the design and principle of operation of three of the comparators: mechanical, electrical, and pneumatic. 8.2 List the merits and demerits of the comparators listed in 5.4. 8.3 Describe method of obtaining magnifications in the comparators listed in 5.4. 8.4 Describe the method of setting up the comparators for gauging shafts and holes. 8.5 Describe practical application of the comparatives listed in 5.4	direct measurement and also list the essential elements of a comparator ▪ Ask students to explain the design principles and operation of Mechanical, Electrical and Pneumatic Comparators. ▪ Ask students to describe methods of magnification and give merits and demerits of the three comparators. ▪		centre lathe, drilling machine, milling machine and shaping machine	te the following (A) Coaxial alignment (B)Parallelism (C)Squareness. Concentricity and end float of spindles	
	General Objective 9.0: Understand the principles of angular measurement					
10	2.1 List four angular measuring instruments 2.2 Explain the working principles of the angular measuring instrument listed in 6.1 2.3 State the precautions to be observed when using the angular measuring instrument listed in 6.1. 2.4 State the functions of a gear 2.5 Define the elements and standard proportion of gears.	▪ Ask students to list the different types of angular measuring instruments and explain their working principles. ▪ Ask students to explain the care that must be taken in using angular measuring instrument ▪ Ask students to explain different types of errors and deviation in gear that could affect its accuracy.				

	2.6 Name the possible errors and deviations on a gear affecting it's accuracy and fit. 2.7 Explain the use of standards for specifying the tolerance and fits of gears. 2.8 Describe a double flank test on a gear and interpret the obtained graph. 2.9 Describe the method of measuring the error of involute form on a gear tooth and interpret the graph	▪ Ask students to give standards for specifying the tolerance and fits of gears. ▪ Ask students to obtain graphs from double flank test on a gear ▪ Ask students to determine error of involute from gear tooth and interpret the graph.				
	General Objective10.0: Understand the measurement of gears and identify their accuracy grade					
11	10.1 Describe the method of measuring the error of a pressure line and interpret the graph. 10.2 Describe the method of measuring the base pitch on a gear. 10.3 Describe the method of measuring the simple and cumulative errors of circular pitch and draw the graph and interpret. 10.4 Use the values measured to designate the accuracy grade for the gear.	▪ Ask students to measure base pitch on a gear simple and cumulative errors of circular pitch and interpret the graphs. ▪ Ask students to use values obtained to determine the accuracy grade of the gear. ▪	Marker, markerboard			
	General Objective 11.0: Understand the principles of simple interferometric measurement					

12	11.1 Explain the phenomenon of interferometry. 11.2 Explain the use of optical flat in measurement of small deviations in size, error of flatness and parallelism. 11.3 Describe the principles of design and operation of the NPL gauge interferometer and the diffractional method of slip gauge size evaluation. 11.4 Describe the principles of design and operational of the laser interferometer. 11.5 Describe other applications of laser interferometer like diffractional measurement and holography.	▪ Ask students to describe the phenomenon of interferometry ▪ Ask students to explain the principles of operation of the NPL gauge interferometer and the fractional method of slip gauges. ▪ Ask students to describe the working principle of laser interferometer and its applications.				
	General Objective 12.0: Know the purpose and types of alignment tests for common types of machine tools					
13-15	12.1 State the purpose of no-load running tests. 12.2 State the purpose of practical alignment tests. 12.1 List and state the uses of the following equipment used for alignment tests: precision level, dial test indicator, test mandrel, straight edge and square. 12.2 Sketch and describe the following alignment tests for common machine tools (a) coaxial alignment (between axes) (b) parallelism (c) squareness or perpendicularity (d) concentricity and end float of spindles.	▪ Ask students to explain the purpose of no-load running test and practical alignment tests. ▪ Ask students to list and explain the uses of equipment used for alignment tests. . ▪ Ask students to report on the practicals of 9.6 and 9.7.				

	12.3 State the effect of alignment error on the workplace 12.4 Compare the results of the test in 9.6 with standard values in alignment charts and machine tool brochure.					

Assessment: Give details of assignments to be used:

Coursework 20%; Course test 20%; Practical 20%; Examination 40%

Recommended Textbooks & References:

Marine Plant Service and Maintenance

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: MAR 202**		**Contact Hours: 5**
	Subject/Course: Marine Plant Service And Maintenance			**Theoretical: hours/week**
	Year: *Semester:*	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Know the need for and type of plant maintenance

2. Know the components of a marine diesel engine

3. Understand marine plant faults diagnosis and correctives actions

4. Understand the routine maintenance procedure of a marine diesel engine

5. Know the correct procedure for preparing a boiler an its mountings for survey

6. Know the correct procedure for overhauling the compressor

7. Know the correct procedure for preparing the air vessel and valves for survey

8. Understand the steering gear system

9. Understand the specific faults which occurs in pumps and how to rectify them

	Course: Marine Plant Service and Maintenance	**Course Code: MAR 202**			**Contact Hours: 5**	
					Theoretical: hours/week	
	Year: *Semester:*	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Know the need for and type of plant maintenance					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	MARINE DIESEL ENGINE 1.1 Define breakdown maintenance, routine maintenance/servicing, planned maintenance, preventive maintenance. 1.2 State the importance of the use of machinery manufacturers' manual in plant maintenance.	Discuss 1.1 and 1.2	A typical machinery manufacturer 's manual			
	General Objective 2: Know the components of a marine diesel engine					
2				Identify the major components of a marine diesel	Illustrate with a large diagram visit to engine plants	Writing material drawings and photographs samples of engine

				engine.		component s.
	General Objective 3: UNDERSTAND MARINE PLANTS FAULT DIAGNOSIS AND CORRECTIVE ACTIONS					
3	FAULT DETECTION AND REMEDIES 3.1 Outline common faults. 3.2 Explain the causes of the faults in 2.0 above.	Discuss and Illustrate	DITTO			.
	General Objective 4: ***Understand the routine maintenance procedure of a marine diesel engine***					
4-5	MAINTENANCE PROCEDURE OF COMPONENTS 4.1 State the maintenance procedure for each of the following marine engine component main bearing: piston and rings, fuel injectors, fuel pumps, heat exchangers and filters. 4.2 Explain the procedure for calibration of fuel pumps. 4.3 Explain shipboard tests for contamination of lubricating oil. 4.4 List the causes and prevention of crankcase explosions and scavenge fires. 4.5 Explain common faults of governors. .	Demonstrate, explain and have students perform activities in 4.1 – 4.8. Conduct visits to ships and operate systems there.	Sample boiler burners, sample boiler gauge glasses, boiler water test kits, sample boiler safety valve.	4.6 Blead the fuel system of the engine. 4.7 Check fuel system of the engine for tension. Carry out emergency stopping procedure of the engine 4.8 Service a turbo charger. 4.9 Replace worn	***Sample boiler burners, sample boiler gauge glasses, boiler water test kits, sample boiler safety valve.*** Demonstrat e, explain and have students perform activities in 4.1 – 4.8.	*Sample boiler burners, sample boiler gauge glasses, boiler water test kits, sample boiler safety valve.*

				piston and rings. 4.10 Check tappet clearances . 4.11 Grind poppet valves. 4.12 Assemble poppet valves and time them clean fouled coolers. 4.13 Sketch indicator diagrams and identify possible faults. 4.14 Take cylinder liner bore gauge. 4.15 Take crankshaft deflections. 4.16 Time the fuel	***Conduct visits to ships and operate systems there.***	

				pumps		
	General Objective 5: ***Know the correct procedure for preparing a boiler an its mountings for survey***					
6-8	MAINTENANCE PROCEDURE OF BOILER AND MOUNTINGS 5.1 Describe the blow down process of a boiler, open up, clean both water and gas sides in readiness for survey, e.g, economizers, super heaters, combustion chamber and furnace. 5.2 Dismantle, clean and prepare boiler mountings for survey paying particular attention to the safety valve and the gauge glasses. 5.3 Explain how boiler water is tested. 5.4 Describe the fuel line arrangement of the burner and also explain the operation of the remote control for shutting down the burner in an emergency 5.5 Explain how boiler valve seats are grounded 5.6 State the methods of detection of leaking boiler tubes and how to plug them 5.7 State the method of servicing the burner system, e.g., nozzle, electrodes and filter 5.8 Explain how to test alarm system.	Demonstrate, explain and have students perform activities in 5.1 – 5.8. Conduct visit to ships and operate systems there	Sample boiler burners, sample boiler gauge glasses, boiler water test kits, sample boiler safety valve.			

	General Objective 6: : ***Know the correct procedure for overhauling the compressor***					
9-10	MAINTENANCE OF COMPRESSORS 6.1 Describe the precise order for dismantling the compressor. 6.2 Remove valves, inter-coolers and the after cooler. 6.3 State the common faults in compressor valves and coolers and how to detect these faults. 6.4 Over-haul bigend and main bearings emphasizing the need to check oil holes and passages in shaft volume and determine compression ratio of a compressor. 6.5 Check clearance	Demonstrate and have students perform tasks in 6.1 – 6.5	Samples of compressor valves, inter coolers, crankshaft, connecting rods and bearings. Demonstration compressor.			.
	General Objective 7: ***Know the correct procedure for preparing the air vessel and valves for survey***					
11-12	MAINTENANCE OF AIR VESSELS 7.1 List the type of tools required for cleaning the internals. 7.2 State safety precautions necessary for servicing pressurized vessels. 7.3 Fill the air vessel and check for leaks and stress the importance of regular operation of the drain cock. 7.4 State the importance of the air vessel relief valve, fusible plug, manhole mud doors; also state the need for regular inspection of these fittings. 7.5 State the importance of the internal coating in air vessel and the need for the regular maintenance of this coating.	Demonstrate, explain and have students perform tasks in 7.1 – 7.5. Visit to a ship	Typical air vessel with fittings			

	General Objective 8: ***Understand the steering gear system***					
13-14	STERERING GEAR SYSTEM 8.1 Carry out tests and checks on steering gear system prior to sailing. 8.2 Explain actions required on total failure of the tele-motor system.	Demonstrate, explain and illustrate with sketches and have Cadet perform tasks in 8.1 – 8.2 Visit to a ship.	Staring gear model and printed digorams.			
	General Objective 9: *Understand the specific faults which occurs in pumps and how to rectify them*					
15	MAINTENANCE OF PUMPS 9.1 Explain how to service a reciprocating pump. 9.2 Explain how to service a centrifugal pump 9.3 Explain how to service a gear pump 9.4 Explain how to service a screw pump	Demonstrate 9.1 – 9.4 and have student practice same	Reciprocating pump centrifugal pump, gear pump and screw pump, tool box.			

Assessment: Give details of assignments to be used:

Coursework/ Assignments %; Course test: %; Practical: %; Projects: %; Examination %

Recommended Textbooks & References

RENEWABLE ENERGY THEORIES AND APPLICATIONS

	PROGRAMME: HND RENEWABLE ENERGY TECHNOLOGY	**COURSE CODE: RET 302**	**CONTACT HOURS: 3HRS/WK; L = 2, P = 1**
	COURSE: RENEWABLE ENERGY THEORY AND APPLICATION		
	YEAR: ONE	*SEMESTER: TWO*	*PRE-REQUISITE:*

Goal: The Course is designed to acquaint the students with the fundamental theory of renewable energy and its application

General Objectives

1. Understand the Basic Concepts of Renewable and Non-Renewable Energy
2. Understand Solar Energy
3. Understand Solar Thermal
4. Understand Solar Photovoltaic
5. Understand Wind Energy
6. Understand Biomass and Bio-fuels

COURSE: RENEWABLE ENERGY THEORY AND APPLICATION		COURSE CODE: RET 302		CONTACT HOURS: 3HRS/WK		
YEAR: ONE		*SEMESTER: TWO*		*PRE-REQUISITE: -*		
	THEORETICAL CONTENT			*PRACTICAL CONTENT*		
	General Objective 1: Understand the Concept of Renewable and Non-Renewable Energy					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-2	1.1 Define the term energy 1.2 Define renewable energy 1.3 Explain the importance of energy to the society. 1.4 Define non-renewable energy. 1.5 List the sources of non-renewable energy. 1.6 List the sources of renewable energy.	Define energy and renewable energy Explain the role of energy. List sources of non-renewable energy and renewable energy.	Recommended textbooks, lecture notes, white board, power point ,projector and prepared slide,etc.	-	-	-
	General Objective 2: Understand Solar Energy					
3-4	2.1 Explain basics of solar energy 2.2 Explain factors to be considered for using solar energy. 2.3 Explain the applications of solar energy.	Explain the basics of solar energy. List factors for using solar.	Recommended textbooks, lecture notes, white board,	-	-	-

		Discuss the application of solar energy	power point ,projector and prepared slide,etc.			
	General Objective 3: Understand Solar Thermal					
5-7	3.1 Define thermal energy. 3.2 Define solar thermal collectors. 3.3 .List the types of solar collectors. 3.4 Explain the working principles of solar collector 3.5 Define the word heat. 3.6 State types of heat movement. 3.7 Explain the solar thermal applications 3.8 State the different types of solar cookers. 3.9 Explain the construction and working principles of different types of solar cookers. 3.10 Explain how solar cookers are maintained and repaired. 3.11 State the advantages and limitations of solar cookers. 3.12 Explain how to construct solar water	Define solar thermal energy, and solar thermal collector. Explain how solar collector works. Define heat and types of heat movement. Explain the solar thermal applications. Explain how solar cooker and solar heater work Explain how to repair and maintain solar cooker and solar heater.	Recommended textbooks, lecture notes, white board, power point ,projector and prepared slides etc.	Demonstrate how to design and construct a solar cooker. Perform the process of designing and construction of solar water heater.	Carryout the design and construct a solar cooker. Carryout the Construction of a solar water heater.	Thermometer , glass, shoe box with insulating materials, Cu pipe, test tube, saw, nails, multimeters, plywood, radiator, screw driver, hammer, tape,

	heater 3.13 Explain the working principles of water heater. 3.14 State the area of applications of solar thermal systems. 3.15 State the advantages and disadvantages of solar thermal.	List advantages and limitations of solar cooker and solar heater. State the working principles of solar heater. State the area of applications of solar thermal systems. State the advantages and disadvantages of solar thermal systems.				
	General Objective 4: Understand Solar Photovoltaics					
8-10	4.1 Define solar photovoltaic system. 4.2 State types of solar photovoltaic systems. 4.3 Define solar cells. 4.4 Explain the materials used in constructing solar cells. 4.5 Explain how solar cells work. 4.6 Explain how photons are converted to electrons 4.7 What is solar panel and how it works? 4.8 Define solar array. 4.9 Explain the teams as apply to solar photovoltaic energy inverter, batteries, and charge controllers 4.10 State the functions of batteries, charge controller, inverter	Define PV, solar cells and to state the types of PV systems. State the materials used in construction of solar cells. Define solar panel, solar array, and solar module.	Recommended textbooks, lecture notes, white board, power point ,projector and prepared slide,etc.	Perform the process of designing and construction of solar PV	Carryout construction of a solar PV that converts the sun's light into electricity.	Solar panels, batteries, charge controller, inverter, wire cables, voltmeter,

	4.11 List the area of applications of pv. 4.12 State the advantages and disadvantages of pv 4.13 State the difference between Solar thermal and PV 4.14 State the benefits of solar electricity.	State the types of solar charge controller, inverter, batteries State functions of inverter, battery and controller. State solar PV and solar thermal. State the benefits of solar.				
	General Objective 5: Understand Wind Energy					
11-13	5.1 Define the followings: wind and windmill 5.2 Explain the history of windmill and wind turbine. 5.3 Explain the instruments used in measuring wind direction, wind speed, wind power, and wind turbulence 5.4 State the roles of wind power in generating electricity. 5.5 Explain how to calculate the amount of energy in the wind. 5.6 Explain the principles of wind energy conversion. 5.7 Describe the types and characteristics of windmill rotors. 5.8 Explain the types of wind energy	Define wind and windmill. Write the history of windmill and wind turbine. State the types of wind energy technologies State the types of wind	Recommended textbooks, lecture notes, white board, power point ,projector and prepared slide,etc.	Carryout Blades	Prepare a presentation on the history of windmill and wind turbine. Construct a wind turbine	Box fans,

	technologies. 5.9 Explain the types of wind turbine. 5.10 Explain the working principle of wind turbine. 5.11 Give a brief description of wind turbine blades and windmill blades design. 5.12 Give a basic description of calculating the wind power and speed. 5.13 Define anemometer and weather station. 5.14 Explain the types and functions of weather stations. 5.15 Explain design factors that produce efficient wind turbine. 5.16 Explain how wind turbine generates electricity. 5.17 List wind turbine components. 5.18 Explain the other wind power applications. 5.19 Explain what a wind farm is all about. 5.20 State what makes an ideal site for a wind farm. 5.21 State the strengths and weaknesses of wind energy system. 5.22 Explain the area of applications of wind energy. 5.23 Explain the impact of wind energy on the environment	turbine. State the components of wind turbine Describe types of wind turbine blades. Calculate wind power and wind speed Define anemometer and other State the types and functions of weather station. Explain design factors that can produce efficient wind turbine. Describe how wind turbine generates electricity.		construction steps and safety procedures Carryout Turbine construction steps and safety procedures	blade. Construct a wind turbine.	anemometer, standard shop tools, card board, glue. Box fans, anemometer, standard shop tools, card board, glue, ply wood, nails, corriflute, cable ties, generator, glue, hammer

		List wind turbine components. Explain other wind power applications. Explain what a wind farm is. Explain what would make an ideal site for a wind farm. State the strengths and weaknesses of wind energy system. Explain the area of applications of wind energy. Explain the impact of wind energy to the environment.				
	General Objective 6: Understand Biomass and Bio-fuels					

14-15	6.1 Define the term biomass. 6.2 Define the term bioenergy. 6.3 State the sources of biomass. 6.4 State the various energy products from biomass. 6.5 Define biofuels, bio power, bio products. 6.6 Explain the types of biomass used to produce energy. 6.7 Introduction of making biodiesel 6.8 Explain steps of making biodiesel. 6.9 State the benefits of biofuels over fossil fuel. 6.10 State the process of building a biogas digester. 6.11 List the components and the functions of biogas digester. 6.12 Explain areas of application of gas biomass products.. 6.13 State the strengths and weaknesses of bioenergy 6.14 State the environmental benefits of biomass. 6.15 State the environmental constraints of biomass 6.16 Explain ways of converting biomass (thermal conversion, chemical conversion, and biochemical conversion) to energy. 6.17 Draw a block diagram for bioconversion of biomass. 6.18 State the process of gasification and others technology. 6.19 State the advantages and disadvantages of gasification. 6.20 Explain biomass combustion process. 6.21 Define pyrolysis 6.22 State the types of crops used for generating energy.	Define biomass. Define bioenergy. State the sources of biomass. Define biofuel, biopower and bioproducts. Explain the type of biomass used in energy production. State the process of biodiesel production Explain the benefits of biofuels over fossil fuel. State the process	Recommended textbooks, lecture notes, white board, power point ,projector and prepared slide,etc.	Design and Contruct a Biogas Digester Produce oil from Sunflower Seeds Produce oil from Cotton Seeds Produce oil from Jatropha Analyse oils made from Jatropha, Cotton Seed and Sunflower.	Supervise the contruction of Biogas Digester Supervise the production of oil from; Jatropha, Cotton Seeds and Sun flow	**Angle Irons, Hacksaw, Welding Machine, Bolts & Nuts, Iron sheets, Sunflower seeds, Cotton seeds, Jatropha**

	6.23 State the types of energy each crop will generate. 6.24 Explain the production process of these oil crops (sunflower, jatropha, cotton, etc) 6.25 Evaluate the environmental impact of energy generated from these crops. 6.26 Explain the area of applications of energy produced from these crops.	of a biogas digester. List the functions of biogas digester components. Explain the area of applications of biomass products. State the strength and weaknesses of bioenergy. State the benefits and constraints of biomass. Explain the methods of converting biomass into				

		energy. Draw a block diagram for bioconversion of biomass. State the process of gasification and others technology State the advantages and disadvantages of these technologies. Explain the biomass combustion process Define and explain the pyrolysis process.				

		State the types of crops used in generating energy and the type of energy produced. Explain the production process of oil crops. Evaluate the environmental impact of energy generated from these crops. State the area of applications of energy produced from these crops				
ASSESSMENT: The continuous assessment, tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.						

TRANSPORT TECHNOLOGY

Energy and Power in Transportation Systems

	Department/ Programme: HIGHER **NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY**	**Course Code: TRT 301**		**Contact Hours: 3**
	Subject/Course: Energy and Power in Transportation Systems			**Theoretical: 1 hours/week**
	Year: 1 Semester: 1	*Pre-requisite:*		*Practical:2 hours /week*

General Objectives
1. Understand Transportation Systems
2. Understand energy and power
3. Understand Systems of measurement
4. Know engine power measurement

	Course: Energy and Power in Transportation Systems	**Course Code: TRT 301**		**Contact Hours: 3**
				Theoretical: 1 hours/week

	Year: 1 Semester:1	*Pre-requisite:*			*Practical: 2 hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Understand Transportation Systems					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	1.1 Define transportation. 1.2. Describe transportation technological systems	Explain transportation in all modes as well as all technological systems				
2-3	1.3 Describe the elements of a technological system. 1.4. Discuss the importance of the study of transportation	List and explain elements of technological systems. Explain the importance of study of transportation		Identify elements of technological systems	Demonstrate to students the various technological systems	
	General Objective 2: Understand energy and power					

4	2.1 Describe the difference between personal and commercial transportation systems. 2.2 Define energy and explain how it is able to produce motion, heat, and light	Explain the difference between personal and commercial transportation systems Explain energy and various forms of energy conversions				
5	2.3 Identify the six different forms of energy and explain how energy can be changed from one form to another. 2.4 Understand the law of conservation of energy	Explain the laws of energy		Understand various forms of energy conversion	Carry out examples of energy conversions	
6	2.5 Describe the difference between potential and kinetic energy. 2.6 Understand the difference between energy and power	Explain potential and kinetic energy Explain power and energy and give various examples				
	General Objective 3: Understand Systems of measurement					
	3.1 Recognize the difference between two	Explains the types of systems				.

7 8	systems of measurement used throughout the world. 3.2 Explain power measurements and perform a variety of mathematical problems using these measurements	measurement and solve some problems				
	General Objective 4: know engine power measurement					
9	4.1. Describe how engine power is measured, including the operation of measurement devices. 4.2 Recognize how power is developed from energy and identify the three common forms of power	Explain engine power and solve various problems				
10-15				Describe how engine power is measured, including the operation of measurement devices. Recognize how power is developed from energy.	Carryout engine power measurement using a dynamometer.	Engine, Dynamometer, and other tools

Coursework/ Assignments 10%; Course test: 10 %; Practical: 20 %; Projects: %; Examination 60 %

Recommended Textbooks & References

Energy Systems and the Environment

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT**		**Contact Hours: 2**
	Subject/Course: Energy Systems and the Environment			**Theoretical: 2 hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand energy sources and conversions
2. Understand how use of energy causes pollution
3. **Understand and describe energy use (how it is able to produce motion, heat, and light) as it is applied in transportation systems**
4. **Understand Energy Systems and the Transport Environment**

	Course: Energy Systems and the Environment	**Course Code:**		**Contact Hours: 2**

					Theoretical: 2 hours/week	
	Year: 1 Semester:2	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Understand energy sources and conversions					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	1.1 Recognize that all sources of energy fall within one of the following categories: exhaustible, renewable, and inexhaustible. 1.2 Define exhaustible, renewable and inexhaustible energy source	Explain energy sources and their categories.				
2-3	1.5 Understand how energy originates and is converted into controlled forms that are used in transportation, business, industry, and in residential and commercial areas. 1.6 List and describe the six forms of energy found in our universe	Explain ways of energy conversions and the forms of energy available in the universe List and describe the six forms of energy found in our universe				

	General Objective 2: understand how use of energy causes pollution					
4-5	2.2 Describe the potential effects of the carbon dioxide build-up from burning fossil fuels	Explain the formation of carbon dioxide from fossil fuels with relevant formulae				

	General Objective 3.0: Understand and describe energy use (how it is able to produce motion, heat, and light) as it is applied in transportation systems.					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
6-10	3.1. What is Energy? 3.2. Define energy. .List examples. 3.3. Explain the various Types of Energy. . Kinetic energy . Potential energy 3.4.Explain and Identify Forms of Energy such as: . Mechanical . Electrical . Light . Chemical . Nuclear . Heat 3.5. What is Power? 3.6. Define Power. . The rate of doing work. . List examples. 3.7. Explain the Measuring Systems in . Metric . Measurement Conversions 3.8. Measuring Energy and Power. . Work . Power	Define energy and explain how it is able to produce motion, heat, and light. Explain the difference between potential and kinetic energy. Explain the six different forms of energy and how energy can be changed from one form to another. Understand the law of conservation of energy. Teach the student to understand the difference between energy and power.	Recommended text books, Lecture notes, related journals and materials and internet			

	. Horsepower . Torque . Bore . Area of Bore . Engine Displacement					

General Objective 4.0: Understand Energy Systems and the Transport Environment.					
Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
4.1. Define exhaustible, renewable and inexhaustible energy sources. 4.2.list Exhaustible Sources of Energy (Non-renewable) 4.3. Know the Renewable Sources of Energy 4.4.know Inexhaustible Sources of Energy 4.5. Describe the Alternative Energy for Transportation A. Shale and Tar Sands-(liquid fuels) B. Solar Biomass-(low hydrogen liquid fuels) C. Hydrogen D. Solar-(sun) E. Wind F. Water G. Electric H. Fuel Cell I. Hybrid 4.5. Understand how energy originates and is converted into controlled forms that are used in transportation, business, industry, and in residential and commercial areas.	Explain all sources of energy which fall within one of the following categories: exhaustible, renewable, and inexhaustible. E.g. Coal, Natural gas ,Oil ,Nuclear Explain the Renewable Sources of Energy Explain Inexhaustible Sources of Energy E.g. Solar, Hydroelectric, Geothermal ,Wind ,Hydrogen Explain how energy originates and is converted into controlled forms	Recommended text books, Lecture notes, related journals and materials and internet			No prac

4.6. List and describe the six forms of energy found in our universe. 4.7 Define pollution and identify the ways the use of energy causes pollution. 4.8. Destroying the Environment. A. Air Pollution: Describe the potential effects of; (1) Smog (2) Carbon Monoxide (3) Particulates (4) Earth Warming B. Water Pollution (1) Acid Rain: Explain how acid rain is formed and the effects it is having on the environment. (2) Thermal Pollution C. Pollution from the Alternative Sources of Energy. (1) Wood (2) Geothermal Energy (3) Hydroelectric Energy (4) Nuclear Energy (5) Solar Energy-(future)	that are used in transportation, business, industry, and in residential and commercial areas. Explain pollution and its effects on the environment. Describe the potential effects of the carbon dioxide build-up from burning fossil fuels. Explain the different uses of energy in transportation. Discuss the general uses of energy in society and Identify energy used in transportation vehicles.				

Assessment: Give details of assignments to be used:

Coursework/ Assignments 10%; Course test: 30 %; Practical: %; Projects: %; Examination 60 %

Recommended Textbooks & References:

Transportation and the Environment

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT	**Course Code: TRT**		**Contact Hours: 2**
	Subject/Course: Transportation and the Environment			**Theoretical: 2 hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. **Understand transportation and the environment**
2. **Understand transportation safety**
3. **Understand vehicular emission and its various standards**
4. **Understand vehicle owners responsibility**
5. **Understand the effects of transportation in various aspects of the community**

	Course: Transportation and the Environment	**Course Code:**		**Contact Hours:**
				Theoretical: hours/week
	Year: 1 Semester:2	*Pre-requisite:*		*Practical: hours /week*
	Theoretical Content		*Practical Content*	
	General Objective 1: understand transportation and the environment			

Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1	1.1 Describe the environmental impact of various modes of transportation (e.g., tail-pipe emissions, noise pollution, water contamination and habitat degradation, bird and animal strikes). 1.2 Describe the pros and cons of using environmentally friendly products (e.g., biodegradable cleaners) and procedures (e.g., recycling of materials) when servicing and/or maintaining vehicles and/or craft; 1.3 Research and report on ways in which the transportation industry affects the environment and on efforts being made to remedy or reduce harmful effects(e.g., improved production methods, automotive parts recycling), including ways of disposing of waste products (e.g., used oil,used batteries, used paint/thinners);	Explain the impact of transportation on the environment with various examples	Recommended textbooks, whiteboard, Marker,etc			
	General Objective 2: understand transportation safety					

2	2.1 Describe the development of improved safety features in transportation technology (e.g., airbags, anti-lock brakes); 2.2 Describe recent technological innovations (e.g., related to performance, comfort, drivability, fuel economy, recycling of parts) in vehicles and/or craft;	Explain transportation safety features e.g. air bags etc List and explain technological innovations in transportation				
4	2.3 Explain the pros and cons of various means of transporting people/materials (e.g., by road[bicycle, car, bus, truck], rail, air, water) in terms of economy, safety, convenience, and so on	Explain the pros and cons of various means of transporting people/materials in 2.3				
	General Objective 3: Understand vehicular emission and its various standards					
5	3.1 Describe vehicular emission and how the emission carried out.	Explain in details vehicular emission and demonstrate				.

	3.2 Discuss various standards for pollutants, eg. NO, CO etc 3.2Outline the legal requirements and environmental reasons for emission standards and for testing when required	how the test is carried out List various emission standards obtainable around the world for both diesel and petrol engines Give reasons for setting emission standards.				
	General Objective 4: Understand Vehicle owners responsibility					
6	4.1 Describe a vehicle owner 's responsibilities with respect to recycling and/or disposing of waste products (e.g., used oil, used batteries) appropriately; 4.2 know the importance of vehicle maintenance from an environmental perspective (e.g. keeping tires properly inflated helps to maximize fuel efficiency and reduce emissions 4.3 describe the options that vehicle owners have to choose environmentally friendly products (e.g., biodegradable cleaners) and procedures (e.g., recycling of antifreeze) in the repair and service of vehicles	Explain how to recycle or dispose transport waste products as well as vehicle maintenance in relation to Explain the importance of vehicle maintenance from an environmental perspective (e.g. keeping tires properly inflated helps to maximize fuel efficiency and reduce emissions				

7	4.3 Analyse the safety features in today's vehicles(e.g., electronic stability control, airbags, anti-lockbrakes, roll-over protection, engine kill switch) from a consumer 's point of view	Explain safety features in vehicles with various examples.				
	General Objective 5: understand the effects of transportation in various aspects of the community					
8-10	5.1 Describe the economic, environmental, and social effects that various aspects of the transportation industry have on a community (e.g., economic: new businesses encouraged by good transportation links; environmental: pollution caused by exhaust emissions and road salting; social: community links expanded through personal vehicle use) 5.2 Assess from a consumer's point of view the pros and cons (e.g., cost, availability, performance, reliability, emission levels) of various types of fuel/energy sources used to power vehicles (e.g., gasoline, propane, diesel, electrical/battery power, biodiesel, hybrid powerplant).	Explain effects of the transport industry on the community. Explain Environmental impact assessment Explain from a consumer's point of view the pros and cons (e.g., cost, availability, performance, reliability, emission levels) of various types of fuel/energy sources used to power vehicles (e.g., gasoline, propane, diesel,				

		electrical/battery power, biodiesel, hybrid powerplant				

Assessment: Give details of assignments to be used:

Coursework/ Assignments 10 %; Course test: 30 %; Practical: %; Projects: %; Examination 60 %

Recommended Textbooks & References:

ELEMENTS OF TRANSPORTATION TECHNOLOGY

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORTATION TECHNOLOGY	**Course Code: TRT325**		**Contact Hours: 2**
	Subject/Course: ELEMENT OF TRANSPORTATION TECHNOLOGY			**Theoretical: 2 hours/week**
	Year: 1 Semester: 1	*Pre-requisite:*		*Practical: hours /week*

General Objectives
1. Know the meaning of transportation technology
2. Know the transportation systems
3. Know the technological development of transportation technology

4. Understand the electrical vehicles

5. Understand the hybrid vehicles

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORTATION TECHNOLOGY						
COURSE: ELEMENT OF TRANSPORTATION TECHNOLOGY		**COURSE CODE: TRT 325**		**CONTACT HOURS:3 HOURS**		
GOAL: THE COURSE IS DESIGNED TO ACQUAINT THE STUDENTS WITH KNOWLEDGE OF TRANSPORTATION TECHNOLOGY						
COURSE SPECIFICATION: THEORETICAL CONTENT				**PRACTICAL CONTENT**		
	GENERAL OBJECTIVE 1.0: Know the meaning of transportation technology					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**
1 -5	1.1 Define transportation technology 1.2 Describe the nature and characteristics of transportation technology 2.1 Outline the introduction to transportation technology i. Explain the advantage and disadvantage of transportation technology.	Explain transportation technology in details , and its functions List and Explain the types of transportation technology , its characteristics Explain aims and objectives of transportation technology Explain the different between	Whiteboards , markers, Textbook and Journals, audio visuals			

		transportation and technology Explain the factor that affect transportation technology Assess the students' performance				
GENERAL OBJECTIVE 2.0: Know the transportation systems						
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**
6-7	2.1 Define transportation system 2.2 describe the types of transportation system	Explain transportation systems in details. Explain the basic principles of transportation system Explain the functions of transportation system List and Explain the characteristics of transportation system Explain the role transportation system play in our roads Explain the advantage and disadvantage of	Whiteboards , markers, Textbook and Journals, audio visuals			

	2.3 Discuss vehicle design	transportation system Explain the nature of vehicle design Explain the function of vehicle design Explain the characteristics of vehicle design Explain the types of vehicle design				
GENERAL OBJECTIVE 3.0: Know the technological development of transportation technology						
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**
8-11	3.1Define technological development of transportation i. Explain the impact of technological development in transportation and technology ii. Explain the function of technological development to transportation system iii. Explain the role of technological development of transportation technology 3.2 Define the technological concepts i. Explain the basic concepts in the transportation technology	Explain in details the activities in in 3.1 to 3.2 Assess the students	Whiteboards , markers, Textbook and Journals, audio visuals ,internet			

	ii. Explain the function of technological concepts iii. List and explain types of technological concepts iv. Explain the factor that can course delay in the technological concepts					
GENERAL OBJECTIVE 4.0: Know the electrical vehicles						
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**
12-13	4.1 Define electrical vehicles i. Explain the nature of electrical vehicles ii. Explain the function of electrical vehicles iii. Explain the factor to be considered before the electrical vehicles to be put in place iv. List and explain the characteristics of electrical vehicles 4.2 Discuss vehicle engines	Explain in detail 4.1. with illustrations, charts etc Evaluate the student List and explain types of simple engines Explain the basic principles of operating the simple engine List the major factor that can affect the simple engine	Whiteboards , markers, Textbook and Journals, audio visuals ,internet			

		Assess to student				
GENERAL OBJECTIVE 4.0: Know the hybrid vehicles						
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**
14-15	5.1 Define hybrid vehicles i. Explain the nature of hybrid vehicles ii. Explain the function of hybrid vehicles iii. Explain the factor to be considered before the hybrid vehicles to be put in place iv. List and explain the characteristics of hybrid vehicles	Explain in detail 5.1 with Assess to student	Whiteboards , markers, Textbook and Journals, audio visuals ,internet			

Assessment: Give details of assignments to be used:

Coursework/ Assignments 10 %; Course test: 30 %; Practical: %; Projects: %; Examination 60 %

Recommended Textbooks & References:

TRANSPORTATION AND THE SOCIETY

	Department/ Programme: **HIGHER NATIONAL DIPLOMA IN TRANSPORTATION TECHNOLOGY**	**Course Code: TRT 308**		**Contact Hours: 2hrs**
	Subject/Course: TRANSPORTATION AND SOCIETY			**Theoretical: 2 hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand the concept of society

2. Know the Factors that Determine Societal Growth and Development

3. Understand the need for Transportation Planning in Societal Development

4. Understand the Effect of Population on Transportation Planning

5.Recognize the Employment Opportunities in Transportation Sector

6. Understand the Influence of Culture and Politics on Transportation Development

7. Understand the Effects of Transportation Development on the Society

8. Understand Government Policies on Transportation Development

9. Know Environmental Impact Assessment (EIA) of the society

PROGRAMME: HIGHER NATIONAL DIPLOMA IN TRANSPORTATION TECHNOLOGY						
COURSE: TRANSPORTATION AND SOCIETY			**COURSE CODE: TRT 308**		**CONTACT HOURS: 2 - 0**	
GOAL: This course is designed to enable the student understand the relationship between transportation and societal development						
COURSE SPECIFICATION: THEORETICAL CONTENT				**COURSE SPECIFICATION: PRACTICAL CONTENT**		
	GENERAL OBJECTIVE 1.0: Understand the concept of society					
Week	Specific Learning Objectives	Teacher's Activities	Learning Resources	Specific Learning Objective	Teacher's Activities	Learning Resource
1	1.1 Define society 1.2 Identify societal needs 1.3 Explain the need for transportation	i. Define society ii. Highlight societal needs i. Outline the function of	White board, marker, Books Journals Government Publication			

		transportation in society	Internet			
	GENERAL OBJECTIVE 2.0: Know the Factors that Determine Societal Growth and Development					
2	2.1 Differentiate between growth and development 2.2 Identify the factors that determine societal development 2.3 Explain the significance of each factor towards societal growth 2.4 Describe the social-economic effect of transportation system on society	i. Define the concept of growth and development ii. Identify the indicators of societal development iii. Outline the importance of each factor in societal development iv. State the problem of poor transportation system on the society	White board, marker, Books Journals Government Publication Internet Published Articles in Journals			
	GENERAL OBJECTIVE 3.0: Understand the need for Transportation Planning in Societal Development					
3	3.1 Define transportation Planning 3.2 Explain the features of various modes of transportation 3.3 Explain the role of various forms of transportation in meeting societal needs	i. Explain the nature and scope of transportation planning ii. Outline the features of various modes and their role in societal development	White board, marker, Books Journals Government Publication Internet Federal Ministry of Transportation (FMT) Handbooks			
	GENERAL OBJECTIVE 4.0: Understand the Effect of Population on Transportation Planning					
4-5	4.1 Define the concept of	i. Define	White board,			

	Demography 4.2 Explain the determining factors of population 4.3 Explain the relationship between population dynamics and community transportation cost 4.4 Outline the nature of transportation problem in a given community	Demography ii. Highlight the determinants of population size iii. Outline the direct impact of populations on transportation modes iv. Explain and give examples of transportation problem and solution	marker, Books Journals Government Publication Internet Documentaries			
	GENERAL OBJECTIVE 5.0: Recognize the Employment Opportunities in Transportation Sector					
6	5.1 Define employment 5.2 Explain employment opportunities in transportation sector 5.3 State advantages of globalization on transportation sector employment	i. Define employment ii. Outline formal and informal sectors of employment iii. Identify employment opportunities in transportation sector iv. Highlight the implication of globalization on transportation sector on planning	White board, marker, Books Journals Government Publication Internet and Other Relevant Materials			
	GENERAL OBJECTIVE 6.0: Understand the Influence of Culture and Politics on Transportation Development					
7-8	6.1 Define culture 6.2 Explain components of culture 6.3 Identify cultural Indices	i. Define culture ii. Explain mutual and non-mutual components of	White board, marker, Books Journals Government			

	that influence transportation decisions 6.4 Explain political influence on transportation development	culture iii. Explain how cultural tendencies can influence transportation decision iv. Outline government policies on transportation development v. Outline the role of transportation labour union in transportation development	Publication Internet and Other Relevant Materials			
	GENERAL OBJECTIVE 7.0: Understand the Effects of Transportation Development on the Society					
9	7.1 State the effect of transportation on societal growth and development	i. Explain the effect of transportation in societal development	White board, marker, Books Journals Government Publication Internet			
	GENERAL OBJECTIVE 8.0: Understand Government Policies on Transportation Development					
10-11	8.1 Examine provision for transportation sector in the past national development plans 8.2 Examine the present effort of government in transportation policy formulation	i. Trace the history of natural transportation policy ii. Explain the effect of transportation policy on the quality of life	White board, marker, Books Journals Government Publication Internet			
	GENERAL OBJECTIVE 9.0: Know Environmental Impact Assessment (EIA) of the society					
12-14	9.1 Broadly define	i. Trace the history of Environmental	White board, marker, Books			

	Environmental Impact Assessment (EIA) and its processes e.g. Initial Environmental Examination (lEE) and Environmental Impact Studies (EIS) 9.2 Discuss EIA Legal, Policy & Institutional Framework	Impact Assessment (EIA) ii. Explain the effect of Environmental Impact Assessment (EIA) on the society Explain 9.2 in respect to i. international environmental law context ii. Multilateral and bilateral financial institutions environmental safeguards iii. National legislations and institutional framework	Journals Government Publication Internet			

Continuous assessment should be 40% while semester examination should be 60% to make a total of 100%.

Introduction to Intelligent Transportation System, ITS

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 306**		**Contact Hours: 2**
	Subject/Course: Introduction to Intelligent Transportation System, ITS			**Theoretical: 2 hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand Advance Traffic Management System (ATMS)
2. Understand Advanced Traveler Information System, ATIS
3. Understand Advanced Vehicle Control and Safety System, AVCSS
4. Understand Advanced Public Transportation System, APTS

	Course: : **Introduction to Intelligent Transportation System, ITS**	**Course Code: TRT 306**		**Contact Hours: 2**
				Theoretical: hours/week
	Year: 1 Semester:2	*Pre-requisite:*		*Practical: hours /week*
	Theoretical Content		*Practical Content*	
	General Objective 1: Understand Advance Traffic Management System (ATMS)			

Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1 -2	1.1 Define Intelligent Transportation Systems and be able to detect traffic situations. 1.2 Describe how to transmit traffic situations to control center via communication network. 1.3 Develop traffic control strategies by combing all kinds of traffic information.	Explain ITS and its applications. Explain traffic and various ways to overcome traffic problems. Explain how to source traffic information	Recommended textbooks, whiteboard, Marker audio visuals,etc			
	General Objective 2: **Understand Advanced Traveler Information System, ATIS**					
3 -5	2.1 Know how to access real time information in the car, at home, in the office or outdoors as the reference of choosing transportation modes, travel trips and routes. 2.2 Describe how the system works, including changeable message signs, Highway Advisory Radio (HAR), GPS, the internet connection, telephone, fax, cable television, information Kiosk and mobile etc.	Explain real time passenger information systems and how they are applied	Recommended textbooks, whiteboard, Marker audio visuals,etc			
	General Objective 3: **Understand Advanced Vehicle Control and Safety System, AVCSS**					
6 -7	3.1 identify how to apply advanced technologies in vehicles and roads, 3.2 know How advanced technology works in control vehicles in order to reduce accidents and improve traffic	Explain vehicle control systems eg. Intelligent speed adaptation, collision avoidance etc.	Recommended textbooks, whiteboard, Marker audio visuals,etc			.

	safety. 3.3 describe anti-collision warning and control, driving assistance, automatic lateral/longitudinal control, and the long-run plans of automatic driving and automatic highway system.					
	General Objective 4: **Understand Advanced Public Transportation System, APTS**					
8-9	4.1 know How APTS applies the technology of ATMS, ATIS and AVCSS in public transportation in order to improve the quality of service, and increase efficiency and the number of people who take public transportation. The system mainly includes automatic vehicle monitoring, VPS, computer scheduling and E -tickets.	Explain the technology applications in ITS	Recommended textbooks, whiteboard, Marker audio visuals,etc			

Assessment: Give details of assignments to be used:

Coursework/ Assignments %; Course test: %; Practical: %; Projects: %; Examination %

Recommended Textbooks & References:

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 303**		**Contact Hours: 3**
	Subject/Course: TRANSPORTATION TECHNOLOGY FUNDAMENTALS I			**Theoretical:3 hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives
1. Understand Vehicle Engines
2. Understand Vehicle Drivetrains
3. Understand Major vehicle Systems and Components

	Course: TRANSPORTATION TECHNOLOGY FUNDAMENTALS I	**Course Code:**			**Contact Hours:**	
					Theoretical: hours/week	
	Year: Semester:	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Understand Vehicle Engines					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 -3	1.1 identify the function and describe the construction and operation of the major parts of an engine (e.g., piston, crankshaft, connecting rod, camshaft); 1.2 explain how power is produced in the	Explain the various engine parts and their modes of operation Explain the engine power	Recommended textbooks, whiteboard, Marker, audio visuals etc			

	course of an engine cycle (e.g., four-stroke cycle, two-stroke cycle, rotary cycle); 1.3 identify the function and describe the liquid or air pathways and maintenance requirements of various engine cooling systems; 1.4 identify the function and describe the construction and maintenance requirements of an engine lubrication system; 1.5 identify the function and describe the construction and maintenance requirements of an engine fuel system.	cycles Explain engine cooling systems and how they are maintained Explain engine lubrication systems with diagrams Explain fuel systems with diagrams				
	General Objective 2: **Understanding Drivetrains**					
4-7	2.1 describe the various types of drivetrains(e.g., direct, gear to gear, gear and chain, continuously variable systems); 2.2 identify the function and describe the operation of major drivetrain components(e.g., transmission, clutch, differential) 2.3 describe the power flow from engine to final drive (e.g., engine to wheels, engine to propeller, engine to track) in various types of drivetrains.	Explain drivetrains Explain the operation of the transmission, clutch and differentials. Explain how power is transmitted from the engine to the wheels.	Recommended textbooks, whiteboard, Marker,etc			
	General Objective 3: Understanding Major Systems and Components					
	3.1 identify and describe the function of various types of steering/control systems	Explain all major vehicle components systems and				.

9-12	and their components (e.g., **systems:** rack and pinion, recirculating ball, fly-by-wire; **components:** rack, pitman arm); 3.2 identify and describe the function of various types of suspension systems and their components (e.g., **systems:** coil spring, leaf spring, torsion; **components:** coil, leaf, torsion bar); 3.3 identify and describe the function of various types of brake systems and their components(e.g., **systems:** mechanical, hydraulic, electric, pneumatic; **components:** emergency cable, wheel cylinder, magnet, brake chamber); 3.4 identify and describe the function of the electrical system and its components(e.g., battery, fuses, starter); 3.5. Identify and describe major body, hull, and/or fuselage system components (e.g., fender, keel, and fairing).	their functions eg. Steering, suspension, electrical, and brake systems. Etc Explain the function of various types of suspension systems, brake systems, electrical systems, and their components Explain major body, hull, and/or fuselage system components (e.g., fender, keel, and fairing).				

Assessment: Coursework/ Assignments 10%; Course test: 30%; Practical: %; Projects: %; Examination 60 %

Recommended Textbooks & References:

TRANSPORTATION TECHNOLOGY SKILLS I

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 312**		**Contact Hours: 2**
	Subject/Course: TRANSPORTATION TECHNOLOGY SKILLS I			**Theoretical: hours/week**
	Year: 1 Semester: 2	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand Design and Fabrication
2. Understand Maintenance and Repair Techniques
3. Understand Basic Service of Vehicle and/or Craft Systems and Components

	Course: TRANSPORTATION TECHNOLOGY SKILLS I	**Course Code: TRT 312**		**Contact Hours: 2**
				Theoretical: hours/week

	Year: 1 Semester:2	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: understand design and fabrication					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-3	1.1 use a problem-solving process to design and fabricate a project (e.g., a self-propelled vehicle or craft) that demonstrates conversion and use of energy under varying conditions 1.2 use various problem-solving processes and techniques appropriately to solve problems or address challenges related to vehicles or craft; 1.3 apply relevant technological concepts(e.g., concepts related to materials, power and energy, mechanisms) appropriately as they work through problem-solving processes related to vehicles or craft; 1.4 report on the end result of the project and identify possible improvements.	Illustrate with examples how to use problem solving processes (e.g., application of mechanical advantage, varying torque and speed) to do 1.1 Solve some problems Explain 1.3	Recommended textbooks, whiteboard, Marker, graphs, charts etc			
	General Objective 2: **Maintenance and Repair Techniques**					
4	2.1 use technical and product manuals and/or software programs to identify, locate powertrain components and determine recommended service	Explain how to manuals and software	Recommended textbooks, whiteboard, Markerproduct manuals	2.1 use tools required for basic service tasks related to powertrains	Demonstrate use of tools in basic	Hand and power tools, engine oil, fasteners

5-8	procedures and maintenance schedules;		and/or software programs, etc	(e.g., hand and power tools) correctly and maintain the tools in good working order; 2.2 perform basic maintenance procedures related to powertrains (e.g., engine oil change ,basic vehicle/craft inspection, blade or cutting-tool sharpening) safely and correctly; 2.3 perform the correct use of various fastening techniques (e.g., use of fasteners ,sealants, bonding agents); 2.4 carry out demonstrate the safe and correct use of various fabrication and repair	service tasks Demonstrate basic maintenance procedure for vehicle power trains demonstrate the correct use of various fastening techniques demonstrate the safe and correct use of various fabrication	,sealants, bonding agents, engines

				techniques the safe and correct use of various fabrication and repair techniques(e.g., cutting threads, heating, soldering, welding); 2.5 Perform basic engine repair. 2.6understand the function and operation of engine components (e.g., dismantle and reassemble a small engine safely and correctly, making necessary repairs in the process).	and repair techniques Demonstrate basic engine repair. Demonstrate engine overhauling	
	General Objective 3: **Basic Service of Vehicle and/or Craft Systems and Components**					
10-12		.		3.1 locate and identify the major components of	Demonstrate 3.1	hand and power tools, vehicle

				steering/control, suspension, brake, electrical, and body systems when performing basic service on a vehicle or craft; 3.2 perform appropriate measurements related to system components (e.g., tire pressure control, suspension, brake, electrical,; chain, cable, and/or belt tension and wear; specific gravity of engine coolant; battery voltage), making any necessary adjustments to meet manufacturers' specifications; 3.3 Service	Carry out measurements on system component Demonstrat	component, Batteries, etc

				steering/ and body system components (e.g., lubricate body hinges [on doors, hood, trunk or hatch], balance tires, check brake fluid level, check vehicle height, charge a discharged battery) safely and correctly.	e how to service steering and body system components	

Assessment: Coursework/ Assignments 10 %; Course test: 30 %; Practical: %; Projects: %; Examination 60 %

Recommended Textbooks & References:

TRANSPORTATION TECHNOLOGY FUNDAMENTALS II

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 309**		**Contact Hours: 2**
	Subject/Course: TRANSPORTATION TECHNOLOGY FUNDAMENTALS II			**Theoretical: hours/week**
	Year: 2 Semester: 1	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Understand Engines II
2. Understand Electrical and Electronic Circuits and Components.
3. Understand Major Systems and Components II
4. Technological and Mathematical Literacy I

	Course: TRANSPORTATION TECHNOLOGY FUNDAMENTALS II	**Course Code: TRT 309**		**Contact Hours: 2**
				Theoretical: 2 hours/week
	Year: 2 Semester:1	*Pre-requisite:*		*Practical: hours /week*

	Theoretical Content			*Practical Content*		
	General Objective 1: Understanding Engines II					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1-3	1.1 Define terminologies describing internal combustion engines (e.g., top dead centre, over-head camshaft), cylinder configurations (e.g.V6, in-line), and types of measurement (e.g. bore, stroke, cylinder displacement) in terms of engine operation; 1.2 describe the design and construction of various components of an internal combustion engine (e.g., camshafts, pistons, crankshafts, rotors, valves, turbines); 1.3 describe the service procedures required to rebuild, repair, and maintain engines 1.4 describe the principles on which the operation of fuel, lubrication, and coolant systems is based (e.g., **fuel:** volatility;	Explain with illustrations the components of an internal combustion engine Explain the design and construction procedures of the engine components with illustrations, charts and diagrams. Explain 1.3 Explain the principles on which the operation of fuel, lubrication, and coolant systems is based	Recommended textbooks, whiteboard, Marker,micrometer, vernier caliper, torque wrench, dial indicator, bore gauge, etc			

	lubrication: viscosity; **coolant:** heat transfer); 1.5 Explain how engine timing and how it is used to achieve optimal engine performance; 1.6 describe the parts, operation, and care of a variety of precision measuring tools (e.g. micrometer, vernier caliper, torque wrench, dial indicator, bore gauge) and demonstrate proper use of these tools; 1.7 Discuss common procedures for inspecting engine components for wear and faults and demonstrate accurate use of these procedures.	Explain engine timing (e.g., ignition timing, valve timing, mechanical fuel injection timing)and how it brings about optimal engine performance Explain in details 1.6 Explain 1.7 in details (e.g ,check cylinder for taper, check cylinder head for warpage)				
	General Objective 2: **Understanding Electrical and Electronic Circuits and Components**					
4-6	2.1 describe the fundamental concepts and laws related to the flow of electricity (e.g., flow of electrons, magnetic fields, Ohm's law, Kirchhoff's laws) that underlie the electrical components and systems found in vehicles, craft, and powered equipment; 2.2 define electrical units of measure (e.g., volts, amps, ohms) and demonstrate the	Explain the laws as in 2.1 Explain electrical units of	Recommend ed textbooks, whiteboard, Marker,etc			

	ability to read wiring schematics (e.g., wire size and colour, symbols); 2.3 discuss the fundamentals of electronic circuits and components (e.g., on-board computers, diodes, transistors, light-emitting diodes [LEDs]); 2.4 explain the consequences of open, short, ground, and unintentional ground circuits (e.g. electrical surges, voltage drop, voltage spike); 2.5 describe basic procedures involved in circuit repair (e.g., use of heat shrink, use of solder and solder less connections); 2.6 describe the operation of various types of protection devices (e.g., fuses, relays, circuit breakers, fusible links); 2.7 identify various types of batteries (e.g., gel type, lead acid, lithium ion) and describe their construction and applications; 2.8 describe the design and applications of various types of electrical systems	measurements with illustrations Explain in details the design and application of electrical systems (e.g., ignition systems, lighting systems, starting systems, charging systems).				
	General Objective 3: **Understanding Major Systems and Components II**					
	3.1 identify the function and explain the operation of the major components of	explain the operation of the major components of various	Recommend ed textbooks,			.

7-9	various types of steering/control systems; 3.2 describe the operation of the major components of various types of suspension systems (e.g., coil springs, struts, shocks, air springs); 3.3 know the operation of the major components of various types of brake systems (e.g., **mechanical :**emergency brake cable; **hydraulic:** master cylinder; **pneumatic:** air brake chamber); 3.4 Discuss various body components of vehicles, aircraft, and/or watercraft (e.g., fenders ,doors, wheel wells, rocker panels, hull, fuselage ,roll-over protection system); 3.5 describe common types of body and frame construction (e.g., unibody construction, subframe and structural assemblies, hull construction, airframe construction) in vehicles or craft.	types of vehicle systems with illustrations, charts etc.	whiteboard, Marker, charts, catalogues audio visuals etc			
	General Objective 4: **Technological and Mathematical Literacy I**					
10-13	4.1 demonstrate appropriate use of technical terminology related to vehicle or craft systems and components to processes, tools, and equipment commonly used in the transportation industry; 4.2 define and accurately calculate various measurements related to a vehicle or craft 4.3 prepare reports (e.g., work orders,	Explain how 4.1 are used appropriately Solve some problems in 4.2 (e.g., engine displacement, voltage drop)	Recommend ed textbooks, whiteboard, Marker,etc			

	journals, and parts lists) for a variety of audiences, using appropriate technical language and relevant technical and mathematical knowledge and skills.					

Assessment: Give details of assignments to be used:

Coursework/ Assignments 10 %; Course test: 30%; Examination 60 %

Recommended Textbooks & References:

TRANSPORTATION TECHNOLOGY SKILLS II

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 310**		**Contact Hours: 3**
	Subject/Course: TRANSPORTATION TECHNOLOGY SKILLS II			**Theoretical: hours/week**
	Year: 2 Semester: 1	*Pre-requisite:*		*Practical: 3 hours /week*

General Objectives

1. Engine Service and Repair
2. Electrical Circuit Testing and Repair
3. Service and Repair of Steering/Control, Suspension, Brake, and Body Systems

	Course: TRANSPORTATION TECHNOLOGY SKILLS II	**Course Code: TRT 310**		**Contact Hours: 3**
				Theoretical: hours/week
	Year: 2 Semester:1	*Pre-requisite:*		*Practical: 3 hours /week*
	Theoretical Content		*Practical Content*	
	General Objective 1: Engine Service and Repair			

Week/s	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1				1.1 Access engine specifications, trouble charts, and/or diagnostic procedures from reliable information sources (e.g., shop manuals, online information, manufacturers' information) and use them as required to service or repair engines; 1.2 use a variety of hand, power, and specialty tools safely and correctly to perform basic maintenance and repair procedures (e.g. **maintenance:** oil change, tune up; **repair:** replace the	demonstrat euse a variety of hand, power, and specialty tools safely and correctly to perform basic maintenanc e and repair	Recommen ded textbooks, whiteboard, Marker,han d, power, and specialty tools, diagnostic tool,etc

				timing belt, repair a fluid leak) on several types and styles of engines, to manufacturers' specifications; 1.3 use a variety of tools and equipment (e.g. fuel pressure/vacuum gauge, compression tester, coolant pressure tester, stethoscope, manometer) safely and correctly to diagnose basic engine condition; 1.4 perform correct diagnostic and repair procedures in disassembling and reassembling an engine (e.g., perform a visual inspection,	procedures demonstrate correct diagnostic and repair procedures in disassembling and reassembling an engine	

				measure component wear, replace or refurbish components, use proper assembly torque and sequence operations).		
	General Objective 2: **Electrical Circuit Testing and Repair**					
3				2.1 possess a working knowledge of inspection and testing of circuits (e.g., use test lights or multi meters when required, follow correct procedures in performing a voltage drop test); 2.2 use a variety of test equipment (e.g., starter circuit tester, charging system analyser) to determine continuity and measure voltage, amperage, and	demonstrate inspection and testing of circuits and use variety of test equipment	Recommended textbooks, whiteboard, Marker,multimeters , starter, circuit tester, charging system analyser

				resistance in various electrical circuits (e.g. starting circuits, charging circuits, lighting circuits); 2.3 perform repairs on electrical circuits (e.g., terminal repair, wiring repair) safely and correctly.		
	General Objective 3: **Service and Repair of Steering/Control, Suspension, Brake, and Body Systems**					
7		.		3.1 perform an inspection of steering/control, suspension, brake, and/or body components, and report on their condition, referring to appropriate information sources (e.g., manufacturers' specifications) and using appropriate technical		Recommended textbooks, whiteboard, Marker,Hand tools, Welding Machine,etc

				language and/or illustrations; 3.2 perform routine and/or scheduled service procedures on steering/control, suspension, and brake systems (e.g., lubrication, brake service, suspension inspection, belt and track adjustment, tire service, fluid change) safely and correctly, using appropriate service information; 3.3 perform service and repair procedures on various body components, using appropriate fasteners and bonding agents	Carryout routine and/or scheduled service procedures on steering/control, suspension, and brake systems	

				(e.g., bolts, welds, rivets, clips, adhesives).		

Assessment: Coursework/ Assignments %; Course test: 10 %; Practical: 30 %; Projects: 60 %

Recommended Textbooks & References:

VEHICLE OWNERSHIP FUNDAMENTALS

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 311**		**Contact Hours: 2**
	Subject/Course: VEHICLE OWNERSHIP FUNDAMENTALS			**Theoretical: 2 hours/week**
	Year: 2 Semester: 1	*Pre-requisite:*		*Practical: hours /week*

General Objectives

1. Know Vehicle Selection
2. Understand Vehicle Registration and Ownership
3. Know Vehicle Loans and Insurance
4. Understand Roadside Emergency Precautions and Procedures
5. Understand vehicle management
6. Know the different types of vehicle ownership

	Course: VEHICLE OWNERSHIP	**Course Code: TRT 311**			**Contact Hours: 2**	
					Theoretical: hours/week	
	Year: 2 Semester:1	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Know Vehicle Selection					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 -2	1.1 Identify various vehicle makes, models, and body styles and compare their features, options, and price; 1.2 outline the factors that determine the value of a used vehicle (e.g., year, mileage, appearance, mechanical condition, warranties, vehicle history, options); 1.3 Know the factors that an owner should consider when selecting the most appropriate vehicle to purchase or lease (e.g., cost, size and type of vehicle, fuel economy [and government incentives, if applicable], ergonomics, intended type and frequency of vehicle use, time of year) and explain their importance; 1.3 Know the reasons for "road testing" a vehicle before purchase (e.g., to determine comfort and visibility, check for noise, test brakes and steering, assess performance and	Explain vehicle makes, models, body styles and discuss on how best to choose options Explain 1.2 in details with relevant examples Explain criteria for vehicle selection Discuss why road testing is relevant before buying a vehicle	Recommended textbooks, whiteboard, Marker,Internet, etc			

	handling); 1.4 Describe on the basis of research various sales and marketing practices encountered in purchasing or leasing a vehicle (e.g., high-pressure sales tactics, use of black or red book evaluations); 1.6 Describe potential issues involved in purchasing a vehicle from various sources (e.g., dealerships, used car retail outlets, auctions, private sellers, and Internet websites).	Explain marketing and sales practices in purchasing or leasing vehicles Explain issues in 1.6				
	General Objective 2: **understand Vehicle Registration and Ownership**					
3	2.1 Describe on the basis of research the legal requirements associated with owning and operating a vehicle (e.g., fees, taxes, licensing, permits, proof of insurance); 2.2 Describe the conditions that must be met to register a vehicle (e.g., safety standards inspection, emissions test, proof of insurance); 2.3 Know the purpose of and the protection provided by the Used Vehicle Information Package.	Explain legal requirements associated with owning and operating a vehicle Explain vehicle registration conditions Explain the purpose of and the protection provided by the Used Vehicle Information Package	Recommend ed textbooks, whiteboard, Marker,etc			
	General Objective 3: **understand Vehicle Loans and Insurance**					
7	3.1 Identify appropriate resources for use in the selection of a vehicle loan or lease and insurance policy;	Explain appropriate resources that are available for use in the selection of a vehicle loan or lease and	Recommend ed textbooks, whiteboard, Marker,etc			.

		insurance policy				
	3.2 Know vehicle insurance coverage requirements and options (e.g., **requirements:** third-party liability coverage, statutory accident benefits cover-age; **options:** collision or upset coverage, comprehensive coverage, loss of vehicle use coverage);	Explain vehicle insurance coverage requirements and options				
	3.3 Know the factors that affect the cost of vehicle insurance (e.g., age and model of vehicle, age and gender of policy holder, driving record);	explain the factors that affect the cost of vehicle insurance				
	3.4 compare the overall cost of loans from various sources (e.g., banks, finance companies, private lenders);	explain and compare the overall cost of loans from various sources				
	3.5 compare the advantages and disadvantages of purchasing versus leasing a vehicle (e.g., with regard to short-term and long-term costs, ownership, and responsibility for maintenance and repairs);	Discuss and compare the advantages and disadvantages of purchasing versus leasing a vehicle				
	3.6 Describe the criteria financial institutions use to determine eligibility for a loan or lease (e.g. credit history, income, net worth).	Explain 3.6				
	General Objective 4: Know **Roadside Emergency Precautions and Procedures**					
9	4.1 describe the legal consequences and obligations that arise when a driver is involved in an accident and/or charged with a traffic violation (e.g.,	explain the legal consequences and obligations that arise when a driver is involved in an accident	Recommend ed textbooks, whiteboard, Marker,etc			

	consequences: fine, charge, legal action; **obligations**: show proper documentation, remain at the scene of the accident);	and/or charged with a traffic violation				
	4.2 describe the steps to follow when involved in a traffic accident (e.g., with respect to law enforcement involvement, exchanging insurance information, making a claim to an insurance company);	Explain in details the steps to follow when involved in a traffic accident				
	4.3 compare various roadside assistance plans (e.g., manufacturer's plan, aftermarket plan);	Discuss 4.3				
	4.4 Identify safe procedures and recommended techniques (e.g., for jacking, battery boosting, towing) described in the owner 's manual to resolve roadside emergencies (e.g., flat tire, dead battery, vehicle breakdown);	Explain safe procedures and recommended techniques to resolve roadside emergencies				
	4.5 describe the preparations vehicle owners can make to increase driving safety (e.g., trip planning, driver training, keeping the vehicle properly maintained);	Explain the preparations vehicle owners can make to enhance driving safety				
	4.6 describe the precautions vehicle owners can take to minimize the effect of accidents or road-side emergencies (e.g., make sure everyone wears a seatbelt; observe speed limits; have a first aid kit, emergency tool kit, and fire extinguisher in the vehicle; carry a cell phone; wear a helmet when riding a motorcycle).	Explain the precautions vehicle owners can take to minimize the effect of accidents or road-side emergencies				

	General Objective 5: **Understand Vehicle Management**					
10	4.1 Describe vehicle management processes e.g. Maintenance, care, security etc.	explain 4.1in details with relevant examples	Recommended textbooks, whiteboard, Marker,etc			
	General Objective 6: **Know the different types of vehicle ownership**					
11-12	6.1. Know Types of Vehicle ownership. 6.2 Describe Private systems: A. Vehicles and systems for the movement of people. B. Vehicles and systems for the movement of goods. 6.3 Describe public systems A. Describe Vehicles and systems for the movement of people. B. Describe Vehicles and systems for the movement of goods.	Explain in details the types of ownership, public, private, shared, etc	Recommended text books, Lecture notes, related journals and materials and internet			

Assessment: Coursework/ Assignments 10 %; Course test: 30 %; Examination 60 %

Recommended Textbooks & References:

VEHICLE MAINTENANCE I

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 322**		**Contact Hours: 4**
	Subject/Course: VEHICLE MAINTENANCE I			**Theoretical:1 hours/week**
	Year: 2 Semester: 1	*Pre-requisite:*		*Practical: 3 hours /week*

General Objectives

1. Understand Powertrain Components
2. Understand Major Vehicle Systems
3. Know Interior and Exterior Care
4. Know Information, Tools, and Equipment for Basic Service and Maintenance
5. Understand Using Service Information
6. Understand Engine Service
7. Know General Vehicle Maintenance and Service
8. Understand Challenges and Repair Problems

	Course: VEHICLE MAINTENANCE I	**Course Code: TRT 322**			**Contact Hours: 4**	
					Theoretical: 1 hours/week	
	Year: 2 Semester:1	*Pre-requisite:*			*Practical: 3 hours /week*	
	Theoretical Content			*Practical Content*		
	General Objective 1: Understand Powertrain Components					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 -3	1.1 Describe from an owner 's perspective, the basic operation of various engine systems (e.g., lubrication, cooling, starting, ignition, and fuel systems) and the related safety and service considerations; 1.2 Knows the operation of vehicle drivetrain components (e.g., clutch, transmission, driveshaft, differential, axles, and track) and identify those that require regular servicing (e.g., fluid change, lubrication).	Explain, from an owner 's perspective, the basic operation of various engine systems Explain the operation of vehicle drivetrain components with illustrations	Recommended textbooks, whiteboard, Marker, audio visuals etc.	1.1 Describe the types of engine systems (e.g., two-stroke, four-stroke, diesel, petrol, hybrid) used in various vehicles 1.2 identify the components of engines that require regular servicing (e.g., oil and oil filter, air filter, spark plugs);	Show students various types of engine systems Demonstrate 1.2	**Sectioned Engine, Sectioned Clutch, oil and oil filter, air filter, spark plug etc.**

	General Objective 2: **Understand Major Vehicle Systems**					
4-6				2.1 locate and identify various components of vehicle systems that an owner should be aware of (e.g., electrical system – battery; brakes – brake fluid reservoir; steering – tires; suspension – shocks); 2.2 identify typical service requirements (e.g. fluid change, parts replacement) and intervals(e.g., months, kilometres) related to vehicle systems that an owner should be aware of;	Demonstrate 2.1-2.3	**Sectioned Engine, Sectioned Clutch, oil and oil filter, air filter, spark plug, tires, parts, brakes, etc**

				2.3 identify the product information (e.g., tire sizing) and hazards and safety precautions (e.g., battery explosion – wearing safety glasses) that an owner should be aware of when servicing vehicle systems.		
	General Objective 3**: know Interior and Exterior Care**					
7-8	3.1 Describe, on the basis of research, interior and exterior vehicle cleaning and protection products and their applications; 3.2 Identify various types and applications of polishes, waxes, and cleaners for vehicle finishes; 3.3 Describe the pros and cons of various types of body corrosion prevention (e.g., oil, dripless, electronic) available through vehicle dealerships and aftermarket suppliers;	Explain 3.1 Explain application of waxes and the types Explain pros and cons of various types of body corrosion prevention	Recommended textbooks, whiteboard, Marker,	Perform various techniques used to make minor repairs to a vehicle's finish (e.g., stone-chip repair, small-dent repair).	Demonstrate various techniques used to make minor repairs to a vehicle's finish (e.g., stone-chip repair, small-dent repair).	**Hand Tools, waxes etc.**
	General Objective 4**: know Information, Tools, and Equipment for Basic Service and Maintenance**					

9 -11	4.1 consult the owner 's manual as required for specific procedures, specifications, and products (e.g., oils, fluids, fuses, bulbs) related to the maintenance of a vehicle; 4.3 Report on work in progress (e.g., by completing a work order, parts list, and/or journal), using terminology specific to vehicles (e.g., acronyms, service terms); 4.4 Perform mathematical calculations related to vehicle maintenance and operation that are important from an owner 's perspective (e.g. calculate quantities, ratio of water to anti-freeze, fuel consumption), using appropriate resources (e.g., owner's manual, service information); 4.5 Discuss the benefits for an owner in keeping up-to-date service and maintenance records	Explain 4.1 Solve problems Explain the benefits for an owner in keeping up-to-date service and maintenance records	Recommended textbooks, whiteboard, Marker,etc.	Identify the tools and equipment required by a vehicle owner to perform basic service and maintenance procedures	Show students the tools and equipment needed for service	Servicing tools
	General Objective 5: **Understand Using Service Information**					
11	5.1identify and use appropriate service information sources (e.g., shop manuals, online information, manufacturer's information) as required for basic vehicle maintenance and repair; 5.2 Identify the meaning of the letters and numbers of the vehicle identification number (VIN) (e.g., place of origin, engine size, production year) on the basis of their placement in the VIN;	Explain 5.1 Explain how to interpret VIN	Recommended textbooks, whiteboard, Marker, manuals etc.	locate and apply as required information found in the owner 's manual and on the vehicle when performing basic maintenance and service	Demonstrate how to locate and apply info (e.g., safety warnings, specifications such as tire size and	

				procedures; Locate and correctly interpret graphics commonly found on vehicles and in owner's manuals that depict components being serviced (e.g., jacking a vehicle, rotating tires, installing a serpentine belt).	recommended pressure, identification labels, graphics) Demonstrate how to locate and interpret graphics	
	General Objective 6: Understand Engine Service					
12			.	locate the components of an engine lubrication system (e.g., oil dipstick, oil filter, oil pan drain plug) and safely and correctly service	Demonstrate how to locate component in various systems	Servicing tools

				the system; Locate the components of an engine cooling system (e.g., cooling fins, radiator cap, radiator hoses) and safely and correctly service the system (e.g., perform a freeze point test, system pressure test, boiling point test); locate the components of an engine starting system (e.g., battery, battery cables, starting motor)and safely and correctly service the system (e.g., clean battery connections, use booster cables); locate the		

				components of an ignition system (e.g., spark plugs, ignition wires) and identify those that need to be professionally serviced; locate the components of an engine fuel system (e.g., fuel cap, tank and lines, filter) and identify those that need to be professionally serviced.		
	General Objective 7: Know General Vehicle Maintenance and Service					
11-13				7.1Identify the correct use of hand tools and equipment required for basic service and maintenance (e.g., vehicle jacks, safety stands, wrenches), store	Show the correct use of hand tools and equipment for basic service Demonstrat e basic	Vehicle jacks, safety stands, wrenches etc

				them safely, and maintain them in good working order, and perform maintenance service 7.2Locate the components of the electrical system (e.g., battery, alternator, fuses, light bulbs) and perform basic diagnostic and repair procedures (e.g., check fuse, replace bulb, test and charge battery, install a trailer wiring harness) safely and correctly; 7.3Locate the basic components of the brake system (e.g., rotors, drums, friction	diagnostic and repair procedures Show students brake component and Demonstrate how they are serviced	Battery, alternator, fuses, light bulbs Rotors, drums, friction material, brake fluid

				material, brake fluid reservoir)and identify those that need to be professionally serviced 7.4Perform basic maintenance procedures related to the steering system (e.g., basic wheel and tire service, changing a flat tire) safely and correctly; 7.5Perform tasks related to a vehicle safety inspection (e.g., check lights, horn, wipers, glass, door latches and locks); 7.6 Apply the proper procedures for maintaining the interior and	Demonstrate basic steering maintenance procedure Demonstrate 7.5 Demonstrate 7.6	reservoir

				exterior of a vehicle (e.g., washing and waxing, upholstery cleaning and protection); 7.7 Prepare a vehicle for weather extremes (e.g. winter cold, summer sun and heat); 7.8 Display an understanding of tasks necessary to prepare a vehicle for long-term and/or short-term storage (e.g., add fuel system treatment, perform cylinder fogging, and lubricate body hinges [on doors, hood, trunk or hatch]).	Demonstrate 7.7 Demonstrate 7.8	
	General Objective 8: Challenges and Repair Problems					

15	8.1 Demonstrate the ability to use a problem-solving process to address a given transportation technology challenge. 8.2 Use relevant mathematical skills and apply appropriate scientific concepts to understand a challenge or perform repairs (e.g., **math skill:** calculate clearances; **concept applied:** hydraulics; **challenge:** vehicle height modification); 8.2 Identify issues related to a challenge or repair task (e.g., cost, availability of parts or materials, time required) and explain how these issues could affect the response to the challenge or the performance of the repair;	Identify some problems and them Solve some problems with illustrations Explain 8.2		8.3 Systematically troubleshoot basic repair problems on a vehicle or craft by using an appropriate diagnostic procedure (e.g., gather information, perform tests, generate solutions ,apply an appropriate solution, test the results); 8.5 safely	Demonstrate how to troubleshoot 8.3	

				perform with correct use of variety of soldering, heating, cutting, and welding techniques when performing tasks related to a challenge or repair	Demonstrate the safe and correct use of 8.5	

Assessment: Course test: 10 %; Practical: 30%; Examination 60 %

Recommended Textbooks & References:

Engine Management Systems

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 313**		**Contact Hours: 3**
	Subject/Course: Engine Management Systems			**Theoretical: 1 hours/week**
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: 2hours /week*

General Objectives
1. Understand Engine Management Systems
2. Understand Power Transfer Devices
3. Troubleshooting the Powertrain
4. Modifying Vehicles and/or Craft
5. Technological and Mathematical Literacy

	Course: TRANSPORTATION TECHNOLOGY FUNDAMENTALS III	**Course Code:**			**Contact Hours:**	
					Theoretical: hours/week	
	Year: 2 Semester:2	*Pre-requisite:*			*Practical: hours /week*	
	Theoretical Content			*Practical Content*		
	General Objectives1.0: Understanding Engine Management Systems					
Week/s	**Specific Learning Outcomes**	**Teachers Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1 -3	1.1 Measure and describe the correlations among voltmeter, ammeter, and ohmmeter measurements of an electric or electronic circuit (e.g. effect of resistance on voltage, relationship of resistance to voltage drop); 1.2 identify and describe sensors, actuators, transducers, and control devices commonly used in engine management systems;	Explain how sensors and actuators work with illustrations	Recommended textbooks, whiteboard, Marker,Hand Tools, body repair tools, diagnostics equipment, protective equipment, etc	Perform how to Measure the correlations among voltmeter, ammeter, and ohmmeter measurements of an electric or electronic circuit (e.g. effect of resistance on		Hand Tools, body repair tools, protective equipment, voltmeter, ammeter, and ohmmeter etc

	1.3 know the principles of operation of various engine management systems (e.g., emission control, multiplexing, fuel delivery management, ignition timing management) and describe how these systems are interrelated; 1.4 discuss how environmentally harmful gases are produced through combustion and how the engine management systems control the level of emissions in the exhaust gas (e.g., through after-treatment of exhaust gases, exhaust gas recirculation, vapour recovery, positive crank case ventilation, variable valve timing); 1.5 Describe how engine management systems may be affected by lubrication and coolant systems requiring maintenance (e.g., a thermostat stuck open will cause the engine to run below optimal operating temperature, causing excessive fuel consumption).	Explain the principles of operation of various engine management systems Explain 1.4 in details explain how engine management systems may be affected by lubrication and coolant systems requiring maintenance		voltage, relationship of resistance to voltage drop);		
	General Objectives 2.0: Understanding Power Transfer Devices					
4-6	2.1 describe how energy is converted into motion (e.g., chemical to mechanical, chemical to electrical, electrical to mechanical); 2.2 compare the torque and power	Explain how energy is converted into motion	Recommended textbooks, whiteboard, Marker,Hand Tools, body repair tools, diagnostics			

	characteristics of various power sources (e.g., two-stroke, four-stroke, gasoline, diesel, electric, fuel cell ,hybrid, turboprop, jet); 2.3 evaluate the performance of various power sources (e.g., in terms of transmission output, hydraulic efficiency, volumetric efficiency, horse-power, torque); 2.4 identify and trace the flow of power through the major components of a drivetrain (e.g. transmission to axle, outboard drive, hydrostatic drive); 2.5 describe power flow, gear ratios, and torque multiplication in common mechanical drive systems (e.g., belt, chain, and gear drive systems; variable speed pulleys; planetary gears ets; clutch drives).	Explain torque and power characteristics of various power sources Explain 2.3-2.5 in details with illustrations	equipment, protective equipment, etc			
	General Objectives 3.0: Troubleshooting the Powertrain					
7 -9				3.1systematically troubleshoot problems in vehicles or craft by using appropriate	Solve troubleshoot problems in vehicles or craft by using	Hand Tools, body repair tools, diagnostics equipment, protective equipment, etc

				diagnostic steps (e.g., gather information, generate solutions, choose and apply a solution, validate the repair)and equipment (e.g., scan tool, multi meter, break-out box); 3.2 perform repair of various problems in the powertrain system (e.g., no start; problems with starting system, charging system, ignition system); 3.3 describe symptoms (e.g., noise, vibration, odour, drag) resulting from failure or improper assembly of various powertrain	appropriate diagnostic steps Demonstrate the repair of various faults in the powertrain system Demonstrate how improper vehicle assembly can be identified and repaired	Hand Tools, body repair tools, diagnostics equipment, protective equipment, etc

				components(e.g. , vehicle height has dropped due to a broken coil spring, causing the driveshaft/axle working angle to exceed the manufacturer's specifications ;pulleys are misaligned, causing premature belt wear), and recommend appropriate repairs.		
	General Objectives 4.0: Modifying Vehicles and/or Craft					
10-12	4.1 describe the effects that body modifications(e.g., race kits, lift kits, spoilers, ground effects) have on vehicle or craft dynamics; 4.2 describe the effects that vehicle or craft modifications (e.g., changing tire size, modifying fuel and exhaust systems, changing electronic control modules [ECMs], installing lift and lower kits)	Explain the effects that body modifications have on vehicle or craft dynamics Explain 4.2	Recommended textbooks, whiteboard, Marker,Hand Tools, body repair tools, diagnostics equipment, protective equipment, etc			

	have on interrelated mechanical systems.					
	General Objectives 5.0: Technological and Mathematical Literacy					
13	5.1 demonstrate correct and appropriate use of technical terminology when preparing documentation commonly used in the transportation industry (e.g., trouble trees, flow charts, work orders, technical service bulletins); 5.2 define and correctly calculate measurements related to vehicles or craft (e.g., gear ratios, rotor run-out, engine displacement, efficiencies, output); 5.3 demonstrate an understanding of scientific concepts (e.g., direct and alternating current, expansion when heat is added) as they apply to service and repair procedures; 5.4 prepare technical reports (e.g., work orders, journals, parts lists) for a variety of audiences, using appropriate language and demonstrating competent writing skills and appropriate computer literacy skills	Explain correct and appropriate use of technical terminology when preparing documentation commonly used in the transportation industry Solve problems to calculate measurements related to vehicles or craft (e.g., gear ratios, rotor run-out, engine displacement, efficiencies, output) Explain how to prepare technical reports	.			

Assessment: Course test: 10 %; Practical: 30 %; Examination 60 %

Recommended Textbooks & References:

TRANSPORTATION TECHNOLOGY SKILLS III

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 314**		**Contact Hours: 3**
	Subject/Course: TRANSPORTATION TECHNOLOGY SKILLS III			**Theoretical: 1 hours/week**
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: 2 hours /week*

General Objectives
1. Troubleshooting Engine Management Systems
2. Service and Repair of Drivetrain Components
3. Service and Repair of Steering/Control, Suspension, Brake, and Body Systems

4. Solving Repair Challenges

	Course: TRANSPORTATION TECHNOLOGY SKILLS III	**Course Code: TRT 314**			**Contact Hours: 3**	
					Theoretical: 1 hours/week	
	Year: 2 Semester:2	*Pre-requisite:*			*Practical: 2 hours /week*	
	Theoretical Content			*Practical Content*		
	General Objectives1.0: Troubleshooting Engine Management Systems					
Week/s	**Specific Learning Outcomes**	**Teachers Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	1.1 Access and correctly interpret data provided by the on-board diagnostic system (e.g., dashcodes, on-board diagnostic [OBD] data); 1.2 use trouble charts and manufacturers' diagnostic procedures correctly and appropriately to service problems indicated by on-board diagnostic data;	Explain how to access and interpret data on diagnosis Explain how to use trouble charts in details	Recommended textbooks, whiteboard, Marker,sensors, actuators, control devices, etc.	Use appropriate equipment to diagnose and repair engine control systems and components (e.g., sensors, actuators,	Demonstrate proper use of diagnostic tool to diagnose and repair faults in systems	sensors, actuators, control devices, diagnostic tool, etc

				control devices) according to manufacturers' recommendations; Use the diagnostic equipment to avoid damage to equipment and/or vehicle or craft components (e.g., damage caused by a short circuit, a voltage spike, an ammeter connected in series).		
	General Objectives 2.0: Service and Repair of Drivetrain Components					

3			Recommended textbooks, whiteboard, Marker transmission, clutch, drive shaft,etc.	2.1 inspect and diagnose problems in drivetrain components (e.g., transmission, clutch, drive shaft,outboard drive) in compliance with manufacturers' standards; 2.2 perform service procedures on drivetrain components (e.g., replace and adjust clutch, replace universal joints, replace/repack bearings, replace drive seals, adjust belt or chain) safely and correctly.	Demonstrate how to inspect and diagnose problems in drivetrain components Demonstrate service procedures on drivetrain components	transmission, clutch, drive shaft, multi diag systemetc

	General Objectives 3.0: Service and Repair of Steering/Control, Suspension, Brake, and Body Systems.					
7				3.1 inspect and measure component tolerances when servicing steering/control, suspension, and brake systems and body component alignment (e.g., **steering/control systems:** tire wear ,ball joint play; **suspension systems:** ride height/trim height; **brake systems:** disc thickness, drum diameter; **body alignment:** door	Demonstrate how to inspect and measure component tolerances	steering/control systems,ball joint; suspension systems, brake systems**, etc**

				opening), and compare the results with manufacturers' specifications; 3.2perform procedures and the safe use of specialty tools and equipment in the service and repair of steering/control, suspension, brake, and body system components (e.g., **steering/control :** tie rod fork, tire balancer; **suspension:** coil spring compressor; **brakes:** lathe, dial indicator gauge; **body:** metal inert gas [MIG] welder).	Demonstrate proper procedures and the safe use of specialty tools	
	General Objectives 4.0: Solving Repair Challenges					

9	4.1 access and use appropriate resources (e.g. repair manuals, online resources, equipment instructions) as required to successfully address repair challenges; 4.2 perform an inspection for various repair challenges (e.g., brake service, ball-joint replacement, driveshaft or belt misalignment, transmission repair) and prepare a report on work to be done, including a cost-benefit analysis.	Explain 4.1 Explain 4.2 in details with illustrations and demonstrations	Recommended textbooks, whiteboard, Marker,etc.	perform safely and correctly the use of a variety of soldering, heating, cutting, and/or welding equipment for service repair and modification tasks	Demonstrate the safe and correct use of the tools	ball-joint, driveshaft belt, transmission etc.

Assessment: Course test: 10 %; Practical: 30 %; Examination 60 %

Recommended Textbooks & References:

VEHICLE MAINTENANCE II

	Department/ Programme: HIGHER NATIONAL DIPLOMA IN TRANSPORT TECHNOLOGY	**Course Code: TRT 315**		**Contact Hours: 4**
	Subject/Course: VEHICLE MAINTENANCE II			**Theoretical: 2 hours/week**
	Year: 2 Semester: 2	*Pre-requisite:*		*Practical: 2 hours /week*

General Objectives
1. Understand Vehicle Powertrains

2. Understand Interior and Exterior Care and Maintenance

3. Understand Service and Maintenance

4. Understand Service Information

5. Understand Power train Systems

6. Understand Body, Brake, Steering, and Suspension Systems

7. Understand Repair Problems or Challenges.

	Course: VEHICLE MAINTENANCE II	**Course Code: TRT 315**		**Contact Hours: 4**		
				Theoretical: 2 hours/week		
	Year: 2 Semester:2	*Pre-requisite:*		*Practical: 2 hours /week*		
	Theoretical Content			*Practical Content*		
	General Objective 1: Understand Vehicle Powertrains					
Week/s	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	1.1 Explain the similarities and differences among various engine cycles (e.g., two-stroke, four-stroke, rotary, turbine);	Explain in details the engine cycles with illustrations, diagrams etc	Recommended textbooks, whiteboard,Marker	1.1 Identify the components of an internal combustion	Show students the component of internal combustion engine	camshaft, automatic transmissio n,etc.

2	1.2 Explain powertrain terminology commonly used in the transportation industry (e.g., double overhead camshaft [DOHC], automatic transmission [A/T], all-wheel drive [AWD]);	Explain all powertrain terminologies in details.		engine and describe its operation and the routine service required to keep it operating at peak efficiency; 1.2 Identify the components of a vehicle drive-train (e.g., constant velocity [C/V] joints and boots ,axles, chain or belt drive, power take-off [PTO],transmission)and describe the operation of a drivetrain and the routine service required to keep it	Describe its operation and perform routine service required Show students the component of vehicle drive-train Describe its operation and perform routine service required	

				operating at peak efficiency.		
	General Objective 2: **Understand Interior and Exterior Care and Maintenance**					
3	2.1 Describe, on the basis of research, a variety of interior vehicle cleaning products and their applications; 2.2 Identify the types of polishes, waxes, and cleaners that are appropriate for various vehicle finishes (e.g., exterior base clear coat, gel coat); 2.2 Describe various repair techniques. 2.4 Identify and describe various types of fastening methods (e.g., welding, nut and bolt, riveting, chemical bonding) used in maintenance procedures for vehicles and small-engine products; 2.5 Identify the consequences and legal implications of various vehicle customizations (e.g. ground effects, body alterations, audio systems,light intensity, window tinting).	list vehicle interior cleaning products and their applications explain the appropriate usage of the products list and explain various vehicle repair techniques, and fastening methods	Recommended textbooks, whiteboard, Marker, audio visuals etc	Make minor repairs to a vehicle body finish (e.g. stone-chip repair, small-dent repair); Perform various vehicle repair techniques, and fastening methods	Demonstrate how to make repairs to a vehicle body finish Demonstrate various vehicle repair techniques, and fastening methods	Waxes, and cleaners,exterior base clear coat, gel coat, ., welding, nut and bolt, riveting,chemical bonding, audio systems, etc.

	General Objective 3: **Understand Service and Maintenance**					
7	3.1 locate appropriate information sources (e.g. shop manuals, owner's manual, online databases) and consult as required for specifications, tools, equipment, and procedures used in servicing and maintaining vehicles or small-engine products; 3.2 locate, use, and correctly interpret assembly drawings that depict the components of vehicle systems or small-engine products; 3.3 identify and describe the function of common hand tools (e.g., wrenches, socket/ratchet set, screwdrivers), power tools (e.g., electric drill, die grinder, air ratchet), and equipment (e.g., battery charger, hoist, parts washer) used in servicing and maintaining a vehicle or small-engine product; 3.4 identify and describe the function of common measuring tools (e.g., micrometer, hydrometer, multimeter) used in servicing and maintaining a vehicle or small-engine product; 3.5 perform mathematical calculations related to servicing and maintaining a vehicle or small-engine product (e.g., calculate quantities, ratio of water to antifreeze, fuel consumption), using appropriate resources (e.g., owner's	Explain all information sources to students . Explain with diagrams and illustrations assembly drawings of components of engine systems Explain the uses of hand tools Explain the functions of common measuring tools Solve problems				Recommended manuals,wrenches, socket/ratchet set, screwdrivers, battery charger, hoist, parts washer,etc

	manual, service information); 3.6 report on work in progress and work performed (e.g., by completing a work order,parts list, service record, and/or journal), using appropriate terminology specific to vehicles or small-engine products (e.g., acronyms,service terms).	Explain how to complete reports				
8						
	General Objective 4: **Understand Service Information**					
	4.1 Identify the meaning of the letters and	Explain in details to students	Recommend	4.1Locate	Demonstrate how to	.

9 -10	numbers of the vehicle identification number (VIN) (e.g., place of origin, engine size, production year)on the basis of their placement in the VIN;	how to read Vehicle Identification Number	ed books	information in the owner ’s manual and on the vehicle or small-engine product (e.g. safety warnings, warning light and icon information, computer trouble codes, specifications such as tire size and recommended pressure, identification labels, graphics) and apply as required when performing service and maintenance procedures;	locate information on the vehicle and engine	

				4.3 Identify procedures recommended in the owner ’s manual and/or repair manual for emergency situations (e.g., flat tire, dead battery, vehicle breakdown); 4.4 Perform the correct use of hand, power, machine, and pneumatic tools and equipment required for service tasks (e.g., tire machine, floor jacks and hoists, safety stands, shop tools), store them	Demonstrate how to carry out 4.3 Demonstrate the correct use of hand, power, machine, and pneumatic tools and equipment required for service tasks	

				safely, and maintain them in good working order; 4.5 Remove and replace components (e.g., engine oil, tires) correctly, using appropriate product information and specifications (e.g., engine oil –viscosity and quantity; tires – tire size and load rating) as noted in the owner ’s manual and/or repair manual; 4.6 perform safe operation of a variety of	Demonstrate how accomplish 4.5 Demonstrat	

				heating, cutting, and welding equipment in performing service and maintenance tasks.	e the safe operation of equipment in 4.6	
	General Objective 5: **Understand Power train Systems**					
11-12				5.1 Perform service procedures on an engine lubrication system (e.g., change engine oil, change oil filter) safely and correctly; 5.2 Perform inspection and service procedures on an engine fuel system (e.g., change fuel filter)safely and correctly; 5.3 Perform inspection, testing, and service	Demonstrate service procedures on an engine lubrication system Demonstrate service and inspection procedures on an engine fuel system Demonstrate service and inspection	

				procedures on an engine cooling system (e.g., perform pressure test, test freezing/boiling point)safely and correctly; 5.4 Perform inspection and service procedures on an engine ignition system(e.g., replace sparkplugs, replace ignition wires) safely and correctly; 5.5 Perform inspection, testing, and service procedures on an electrical system (e.g., test fuses, charge battery, inspect alternator) safely and	procedures on an engine cooling system Demonstrate service and inspection procedures on an engine ignition system Demonstrate service and inspection procedures on an electrical fuel systems	

				correctly; 5.6 Identify drivetrain components (e.g., transmission dipstick, differential fill plug, transfer case level plug) and perform drivetrain maintenance and service (e.g., clutch adjustment, fluid level checks) safely and correctly 5.7 Perform inspection and service procedures on an engine exhaust system (e.g., replace a muffler) safely and correctly	Show students component in 5.6 and demonstrate drivetrain maintenance procedures Demonstrate service and inspection procedures on an exhaust fuel system	
	General Objective 6: Understand Body, Brake, Steering, and Suspension Systems					

13-14				6.1 Locate and identify the major components of body, brake, steering, and suspension systems (e.g., fender, emergency brake, pneumatic air brake components, tires, hydraulic steering and brake components, shocks); 6.2 Correctly interpret assembly drawings that depict the components of body, brake, steering, and suspension systems	Show students all component in 6.1 Carryout assembly and disassembly of component parts	Recommended textbooks, whiteboard, Marker,fender, pneumatic air brake components, tires, hydraulic steering and brake components, shocks, etc

	General Objective 7: Understand repair problems or challenges					
15	7.1 Demonstrate the use of an appropriate diagnostic problem-solving process (e.g., use of flowcharts) to solve a repair problem (e.g., no-start condition, no-charging condition); 7.2 report on the repair process or project and its results, and identify possible further repair/service or improvements after completing and testing the repair solution or project.	Explain appropriate diagnostics problem solving processes. Explain how to report on 7.2	Recommended textbook, white boards, and marker	7.1 design and fabricate a transportation-related project (e.g., a welding/metal fabrication project)in response to a challenge, using appropriate tools, equipment, and processes;	Demonstrate how to fabricate transportation related projects	Appropriate tools, welding machine etc

Assessment: Coursework/ Course test: 10 %; Practical: 30 %; Examination 60 %

Recommended Textbooks & References:

References:

1- William H. Crouse and Donald L. Anglin, "Automotive Mechanics" The McGraw Hill Book Company, ISBN 0-02-800943-6

2- Jay Webster, Clifton E. Owen, "Basic Automotive Service & Repair", Delmar Publishers, 2000, ISBN 0-8273-8544-7

3- Don Knowles, "Automotive Technician Certification- Test Preparation Manual", Delmar Publishers, 2001, ISBN 0-7668-1948-5

4- Martin, W. Stokel and Martin "Auto Mechanics Fundamentals", The Goodheart Willcox company, INC,ISBN 1-56637-138-4, 1996

5- Stoekel, Stockel, and Johanson, "Auto Service & Repair", The Goodheart Willcox company, INC, 1996,ISBN 1-56637-144-9

6- Martin W. Stokel, Martin T. Stokel Cluis Johanson "Auto Fundamentals" The GoodheartWillcox company, INC,1996, ISBN 1-56637-1384,

7- William, K. Toboldt, Larry Johnson, and W. Scott Gavthier, "Automotive Encyclopedia" Fundamental,Principles, Operation, Construction, Service, and Repair- The Goodheart -WilIcox company, 1995, INC, ISBN 1-56637-150-3

8- Jack Enjavec "Automotive Technology", Delmar Publishers, 2000, ISBN 0-7668-0673-1

9- Jack Enjavec, Robert Scharff, "Automotive Technology", Delmar Publishers, 1992, ISBN 0-8273-6724-4

10- Robert Bosch GmbH "Automotive Handbook" Published by VDI-Verlag, 1996, ISBN 3-1-419115

11- Duffy, James E., "Auto Engines" The GoodheartWillcox company, INC, ISBN 0-87006A77-3

12- Martin W. Stockel, Martin T. Stockel, and Chris Johanson, "Auto Diagnosis, Service, and Repair", The Goodheart-Willcox Company, Inc., Tinley Park, Illinois, 2003, ISBN 1-56637-910-5

13- Crouse – Anglin, "Automotive Mechanics" - 10th Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6

14- William H. Crouse and Donald L. Anglin, "The Auto Book" – 3rd Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7

15- William H. Crouse and Donald L. Anglin, "Automotive Technician's Handbook", The McGraw-Hill Book Company, ISBN 0-07074751-

RECOMMENDED BOOKS

1. **Energy, Power, and Transportation Technology, 2nd Edition By: Len S. Litowitz and Ryan A. Brown** ISBN: 978-1-60525-555-2
2. **The Transport System and Transport Policy An Introduction Edited by Bert van Wee,** Professor of Transport Policy, Delft University of Technology and Scientific Director, TRAIL Research School, The Netherlands, Jan Anne Annema, Delft University of Technology, The Netherlands and David Banister, University of Oxford, UK
3. **Essentials of Energy Technology: Sources, Transport, Storage, Conservation Jochen Fricke, Walter L. Borst**
   ISBN: 978-3-527-33416-2 462 pages December 2013
4. **Auto Body Repair Technology, 6th Edition James E. Duffy** Indiana State University, President, Beneficial Books and Video
   ISBN-10: 1133702856 | ISBN-13: 97811337028561088 PagesPrevious Editions: 2009, 2004, 1998© 2016 | Published

5. **Mdt: Heavy Equipment Systems (2ND 14 Edition)by Huzij** Publisher CommentsWritten by experienced technicians, MODERN DIESEL TECHNOLOGY: HEAVY EQUIPMENT SYSTEMS, 2nd Edition combines manufacturer-based and universal information into a single, reliable resource. The book's unique focus on off-highway mobile equipment systems

6. **Automotive Technology (6TH 15 Edition)by Jack Erjavec** Publisher CommentsAUTOMOTIVE TECHNOLOGY: A SYSTEMS APPROACH - the leading authority on automotive theory, service, and repair - has been thoroughly updated to provide accurate, current information on the latest technology, industry trends, and state-of-the-art tools

8. **Automatic Transmissions and Transaxles: Shop Manual by Mark Hambaum** Publisher Comments Directly correlating to the ASE testing areas for certified auto mechanics, the Automatic Transmission and Transaxle Set and Shop Manual Package has been thoroughly updated and revised with the latest information and hands-on shop procedures dealing.

9. **Auto Body Repair Technology (5TH 09 - Old Edition)by James E. Duffy**Publisher Comments The single most authoritative information resource available today, Auto Body Repair Technology, 4E explains all aspects of collision repair more clearly and in greater detail than any other collision repair book. Its 7 sections and 29 newly up-to-date

10. **Automotive Technology : Principles, Diagnosis, and Service - Natef Correlated Task Sheets (3RD 09 - Old Edition)**

by James D. Halderman Publisher Comments Package consists of 0131754777 / 9780131754775 Automotive Technology: Principles, Diagnosis, and Service 0132379449 / 9780132379441 NATEF Correlated Job Sheets for Automotive Technology: Principles, Diagnosis, and Service 0137003846 / 9780137003846…

11. **Automotive Electricity and Electronics (Myautomotivekit)by James D Halderman** Publisher Comments This package contains: 0135124069: Automotive Electricity and Electronics 0137052634: NATEF Correlated Task Sheets for Automotive Electricity and...

12. **Automotive Chassis (05 Edition) by Tom Gilles**About the Author Tim Gilles has been active in professional associations for many years. He was president and a board member of the California Automotive Teachers (CAT), a board member and election committee chair of the North American Council of Automotive Teachers...

13. **Automotive Steering, Suspension and Alignment (6TH 14 Edition)by James D. Halderman** Publisher Comments 0133455211 / 9780133455212 Automotive Steering, Suspension, Alignment & NATEF Correlated Job Sheets for Auto Steering, Suspension, Alignment Package consists of: 0132747766 / 9780132747769 Automotive Steering...

14. **Automotive Heating and Air Conditioning -task Sheets (6TH 12 - Old Edition)by Thomas W. Birch** Publisher Comments
This package contains: 0132540479: NATEF Correlated Task Sheets for Automotive Heating and Air Conditioning 0132551535: Automotive Heating and Air...
15. **Computerized Engine Controls (8TH 09 - Old Edition)by Steve V. Hatch** Publisher Comments For technicians who are interested in increasing their diagnostic effectiveness on today's vehicle electronic systems, this book is an absolute "must"! Computerized Engine Controls, 7E tackles both domestic and import engine control systems to help with...

16. **Advanced Automotive Electricity and Electronics (13 Edition)by James D. Halderman** Publisher Comments Advanced Automotive Electricity and Electronics is specifically designed for the second semester of an automotive electrical systems course. The first 12 chapters offer solid review of foundational automotive electronics service and repair procedures...

17. **Pro Paint and Body (02 Edition) by Richardson** Publisher Comments Paint Like the Pros! Pro Paint & Body is a complete resource guide that covers the entire spectrum of automotive paint and body, including the latest technology in paint and paint equipment, and body repair techniques...

18. Transport Technology
By Brian Williams

19. Introduction to Transportation Systems
Joseph Sussman

20. Automotive Engineering
Powertrain, Chassis System and Vehicle Body
Edited by David A. Crolla

21. Hillier's Fundamentals of Motor Vehicle Technology 5th Edition
Book 3 (Chassis and Body Electronics)
By V.A.W. Hillier & David R. Rogers

22. A Text Book on Automobile Chassis and Body Engineering
By Sri. N.R.HEMA KUMAR

WORKSHOP/ LABORATORY EQUIPMENT

S/N	ITEM	QTY
1	lathe with the swing of 330 and length of bed 1500mm with complete accessories	2
2	Centre Universal milling machine complete with accessories	2
3	Surface grinding machine complete with accessories	2
4	Power hacksaw	2
5	Universal cylindrical grinding machine with accessories	4
6	Column/pillar drilling machine	4
7	Pedestal grinding machine	1
8	Box spanners	10
9	Allen Keys (set)	10
10	Flat screw driver (set)	10
11	Philips screw driver (set)	10
12	Drift punches (various sizes), {each size}	10
13	Pin punches (set)	4
14	Micrometers outside 0.25mm 25-50mm 50-75mm and sets of Inside micrometers	5
15	Depth gauge	5
16	Steel rule 300mm	10
17	Calipers (inside and outside)	10
18	Vee block with clamps	5
19	Scribing block	5

20	Surface plate	3
21	Oil can	5
22	Ha Machine reamers (set)nd reamers (set)	4
23	Centre drills (set)	4
24	Twist drills (set	5
26	Thread chaser (Assorted)	2
27	Marking out table	2
28	Dial indicator and stand	10
29	Grease gun	4
30	Angle plates	2
31	Engineer's square	10
32	Vernier calipers (various sizes)	10
33	Fire extinguisher, water and sand buckets	4
34	Work benches for 30 students	30
35	Bench vices	30
36	Pillar drilling machine	1
37	Flat rough file (300mm)	30
38	Round rough file (300mm)	30
39	Round smooth file (300mm)	30
40	Source rough file (300mm)	30
41	Flat smooth file 250mm)	30
42	Half round rough file (150mm)	30

43	Triangular rough file (150mm)	30
44	Triangular rough file (150mm)	30
45	Half round smooth file (250mm)	30
46	try-square	10
47	Dividers	10
48	Wallets of warding file	30
49	Cold chisels (set)	30
50	Scrapers (set)	10
51	Hacksaw frame	10
52	Taps and wrenches (set) metric	30
53	Hand drill	10
54	Tap extractor (set)	5
55	Screw extractor (set)	5
56	Screw driver (set)	10
57	Hammers (assorted weight)	20
58	Wire brush	10
59	Measuring tapes	30
60	Feeler gauges	10
61	Rivet gun	10
62	Welding Goggles	30
63	Electric Hand drill	5
64	Electric hand grinder/sander	2

65	Vernier height gauge	2
66	Mallets (rubber, wood and rawhide)	10
67	Number stamps (set)	2
68	Letter stamps (set)	2
69	Hydraulic press	1
70	Punches (cold) (set)	4
71	Plier (assorted)	10
72	Hand shear	4
73	Welding chipping hammer	4
74	Wire brush (bench type)	4
75	Welding shield	10
76	Hand **Gloves**	10
77	Welding and cutting burner set	4
78	Gas cylinder truck	4
79	Brazing rods (tins)	30
80	Flash gas lighter	10
81	Soldering flux (tin)	10
82	Blow lamps	5
83	Profile cutting machine	1
84	Assorted cutting snips	10
85	Leather Aprons	10
86	Welding transformer	10

87	MIG and MAG welding set	5
88	TIG Welding set	3
89	Acetylene gas cylinder	4
90	Oxygen gas cylinder	4
91	Electrode holder (Set)	10
92	Clamp	10
93	Hydraulic jack (30T)	2
94	Trolley Jacks	2
95	Hoisting pulley block	2
96	Respirator	30
97	Safety face screen (face shield)	10
98	Ear protector	30
99	Complete tools box	5
100	Sledge hammer	1
101	Hand vice	4
102	Bending machine	1
103	Shearing machine	1
104	Punching machine	1
105	Rolling machine	1
106	Spot Welding machine	2