-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

Hanover House
24 Douglas Street
GLASGOW G2 7NQ

NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **0091071** **-Session- 1989-90**

-Superclass- **RB**

-Title- **MATHEMATICS: CALCULUS 2**

-DESCRIPTION-

Purpose

This module is designed to extend the development of integration and differentiation and introduce MacLaurin's series. It can be used within a wide range of vocational programmes such as Engineering.

Refer to the Appendix for guidance on the framework of the mathematics modules.

Preferred Entry Level

81062 Mathematics: Calculus 1 (A) (x $^{1}/_{2}$) and
81086 Mathematics: Calculus 1 (B) (x $^{1}/_{2}$)and 81059 Mathematics & Analysis/Algebra 2 or equivalent

Learning Outcomes

The student should:

1. obtain and use differentials;
2. obtain and use integrals;
3. obtain and use power series for elementary functions;
4. apply mathematical knowledge and skills in a problem solving context.

Content/ Context

Corresponding to Learning Outcomes 1-4:

1. Differentiate products of functions. Differentiate quotients of functions. Differentiate tan x, 1n x, e^x . Find 2nd and higher derivates of functions. Apply 1st and 2nd derivatives to motion of a particle. Relate higher derivatives to behaviour of curves. Identify stationary points for given curves. Identify nature of stationary points by using (a) sign of Ist derivative; (b) value of 2nd derivative. Identify points of inflexion. Sketch curves, identifying critical points and asymptotic behaviour. Apply calculus to problems of optimisation.

2. Integrate e^x, 1/(ax +b). Integrate simple cases of composite functions of form g(f(x)). f'(x). Identify standard forms of integrals. Re-arrange given integrals to standards forms by use of algebraic and trigonometric relationships. Apply integration to finding centroids, moments of inertia, 2nd moment of area, work done, centre of pressure, mean and r.m.s. values.

3. State MacLaurin's series. Use MacLaurin's series for expansion of sin x, cos x, e^x etc. and their products. Use MacLaurin's series to prove approximations to functions and to define integrals.

4. The problems/investigations should involve the application of the content of the other Learning Outcomes. Possible applications are to problems involving maxima and minima, motion of particle and first and second moments of area.

Suggested Learning and Teaching Approaches

Consolidation of skills should not consist entirely of mechanical exercises but should include problem solving in a practical context where possible. Group investigations are to be encouraged.

Computer access is desirable and software packages should be used where appropriate.

Students should maintain a workfile. This should form a complete record of the student's work throughout the module. The tutor should ascertain periodically throughout the module that each student is maintaining the workfile adequately. The workfile should contain (as appropriate) the student's notes, class handouts, completed worksheets, exercises, assignments, report(s) of investigation(s), log book of computer activities and a summary of the important details of the module for later revision purposes.

Assessment Procedures

Acceptable performance in the module will be satisfactory achievement of all the performance criteria specified for each Learning Outcome.

The following abbreviations are used below:

LO Learning Outcome
IA Instrument of Assessment
PC Performance Criteria

LO1 OBTAIN AND USE DIFFERENTIALS

PC The student:

(a) differentiates 1n x, e^x and uses function of a function rule for these functions;
(b) differentiates products and quotients of functions;
(c) finds and uses second and higher derivatives;
(d) sketches curves, identifying any critical points and points of inflexion.

IA Graphical and Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a) logarithmic and exponential functions 4
(b) products and quotients of functions 6
(c) higher derivatives such as x sin x 2 ,/cos(x + /4)
(d) curve sketching such as cubic curves 2

One question may cover more than one topic.

Satisfactory achievement of the Learning Outcome will be demonstrated by the student producing at least 3 correct responses for (a) and for (c) and (d) together and at least 4 correct responses for (b).

LO2 OBTAIN AND USE INTEGRALS

PC The student:

(a) integrates 1/ (ax + b) and exp(ax + b);
(b) integrates expressions of the form g (f(x)). f'(x);
(c) rearranges integrals to standard forms.

IA Calculation Exercise

Topics should be assessed on the number of occasions indicated both (definite and indefinite integrals to be used):

(a) logarithmic and exponential functions 4
(b) integrals such as $x\exp(x^2)$ 2

(c) rearrangement such as $\cos^2 x$, $\frac{(x+1)^2}{x}$ 2

One question may cover more than one topic.

Satisfactory achievement of the Learning Outcome will be demonstrated by the student producing at least 3 correct responses for (a) and for (b) and (c) together.

LO3 OBTAIN AND USE POWER SERIES FOR ELEMENTARY FUNCTIONS

PC The student:

(a) uses MacLaurin's theorem to expand functions;
(b) uses MacLaurin's theorem to expand f (x). g (x);
(c) uses MacLaurin's series to obtain approximations to functions and definite integrals.

IA Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a) expansions of functions such as sin x, e^x, 1n (1 +x) 4
(b) products for function such as e^x sin x
2
(c) applications 2

One question may cover more than one topic.

Satisfactory achievement of the Learning Outcome will be demonstrated by the student producing at least 3 correct responses for (a) and for (b) and (c) together.

LO4 APPLY MATHEMATICAL KNOWLEDGE AND SKILLS IN A PROBLEM SOLVING CONTEXT

PC The student:

(a) interprets a problem;
(b) selects a strategy to solve the problem;
(c) obtains a satisfactory solution;
(d) communicates the solution accurately and logically

IA Assignment

4 problems to test the student's ability to draw together various mathematical ideas and techniques developed in the module. The problems should be expressed in a practical context and each must test the 4 processes in the performance criteria. The 4 problems should take approximately one hour in total to complete.

Satisfactory achievement of the Learning Outcome will be demonstrated by the student completing all 4 processes in the performance criteria for at least 2 of the questions.