COURSE CODE: VCH 603

COURSE TITLE: COMPUTER APPLICATION IN VETERINARY MEDICINE

NUMBER OF UNITS: 2 Units

COURSE DURATION: Two hours per week

COURSE DETAILS:

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COURSE CONTENT:

Basic Terminologies and Concepts in the Usage of Computers

Literature Search from Journals and Encyclopaedia, CD-ROM, Internet

Epidemiological and Statistical Programs; Epizoo, SAS

Veterinary Information System

Disease Modelling for Impact Assessment of Disease Outbreaks

Data base Applications in Keeping of Diagnostic and Clinical Records

Management of Accounts by Use of Spread sheets

COURSE REQUIREMENTS:

This is a compulsory course for all 500 level students in the college of Veterinary Medicine.
In view of this, students are expected to participate in all course activities and have minimum
of 70% attendance to be able to write the final examination

LECTURE NOTES

Basic Terminologies and Concepts in the Usage of Computers

- Computer is an electronic machine that is made-up of devices used of input, processing, storage and output.
- Computers are preferred to other processing tools because they are fast, accurate, diligent, versatile, have large data storage capacity and execute instructions automatically with minimal human intervention.
- Computers have two parts; hardware and software.

Hardware

This is the physical part of the computer. The devices include the following:

Keyboard: this is used to type instructions. It is the direct line of communication between the user and the computer. The keyboard is divided into the following five areas

i)   *Typewriter keys*: These keys are layout of letters, numbers and symbols with two shift keys to convert letters to uppercase.

ii)   *Computer keys*: These are special keys which when used in conjunction with letters, send special instructions to the programme. These include Control keys, ALT keys and window keys. The Ctry and ALT keys are not used by themselves instead they give new meaning to a second key.

iii) *ALT*: The ALT key for example can be pressed along with F4 key (one of the function keys) to close a window on the desktop. Press and hold the ALT key, tap the F4 key (one of the function keys) to close a window on the desktop. Press and hold the ALT key, tap the F4 key and then release both keys.

iv) *CTRL*: The control key abbreviated as control. In most window programs, if the Ctrl key is held down and S is pressed, i.e. Ctrl + S, the document at hand is saved, Ctrl + P is print. Also Ctrl + Esc will pop up the start menu. Always remember to press and hold the shift keys first and then tap the letter key. It is important to note that in some programmes, you can press the Alt and Ctrl keys by themselves. For example, the Alt key can be pressed to activate the menu bar in a windows programme, and Ctrl key to switch off the window screen saver.

Windows key and the short cut menu key sit between the control and the Alt keys on either side of the space bar.

The windows key serves the same purpose as pressing Ctrl + Esc, this pops up the start menu. The short cut menu key displays the short cut menu for whatever item is currently selected on the screen. This is the same as right clicking the mouse on something.

Function Keys

These keys are positioned on the top row of the keyboard. They are labelled F1 – F12 and are used to give specific commands to the computers. Just before the F1 key is the Esc key which when pressed cancels the current operation.

Cursor control keys

These are often called arrow keys there are 4 keys that move the text cursor in the direction of their arrows. Above them are more cursor control keys – the six pack of Insert, Delete, Home, End, Page Up and Page Dn.

Numeric keypad

To the right of the keyboard is the numeric keypad. The keypad has two modes; numeric mode and cursor control mode. When the NUM

LOCK light is lit, the keypad is in the numeric mode. The keys are arranged like a calculator which makes them more convenient to use than the number on the typewriter key area. To enter the cursor control mode, press NUM LOCK to turn the NUM LOCK light off. The enter key is functionally the same as the RETURN KEY.

Enter key

Most PC have enter key instead of return key (Machintosh computers have both), they are essentially the same and performs similar functions. Pressing the enter key is the same as clicking OK in a dialog box. In word processing, pressing enter signifies the end of paragraph.

Tab

Like on a typewriter, pressing Tab moves the cursor over the next tab stop. The computer treats a tab as a single, separate character. When you back space over a tab in a word processing program, the tab disappears completely in one chunk not space by space.

Mouse

This is a handheld controller whose movements on a pad alter the position of the pointer on the monitor. The buttons on its top allow the user to issue command relating to what is being pointed at. The mouse is an essential piece of hardware for the use of Windows Operating System-based package.

Common Windows Editing Keys

Key	Windows Editing Key Commands
←	Moves the text cursor left (back) one character
→	Moves the text cursor right (forward) one character
Ctrl +←	Moves the text cursor left one word
Ctrl +→	Moves the text cursor right one word

Home	Moves the text cursor to the start of the line
End	Moves the text cursor to the end of the line
Delete	Deletes current character
Backspace	Deletes preceding character
↑	Moves the text cursor up one line
↓	Moves the text cursor down one line
PgUp	Moves the text cursor up to the preceding page (screen)
PgDn	Moves the text cursor up to the next page (screen)
Ctrl ↑	Moves the text cursor up to the preceding paragraph
Ctrl ↓	Moves the text cursor up to the next paragraph
Ctrl + Backspace	Deletes current word (or Ctrl + Delete)

Processor

The microprocessor is contained in a thin rectangular circuit board known as the motherboard. The microprocessor is the computer's brain. This is also called the Central Processing Unit (CPU). They are available in 8bits, 16bits, 32bits and 64bits (Pentium), based on the number of commands it can perform per second.

Random Access Memory (RAM)

This is the main CPU's memory or workspace. The basic size of the RAM is 512k and can be expanded as seen in the new computer models beyond 262MB, most computers now come in GB. When the computer is being operated, the software being used is loaded from the hard drive into the RAM while the data generated are stored temporarily in RAM. RAM is volatile and information stored in it would be lost when the computer is turned off or when there is a power outage with no back-up system to the computer.

Software

This is the intelligence part of the computer. It tells the hardware what to do and how to work. Without the software directing things, the

hardware would just sit around and look formidable. **_You must have software to make the computer go_**.

The most important piece of software is the Operating System. The Operating System typically comes with the computer upon purchase; although this can be updated and improved upon from time to time. The most popular Operating System used to be the Disk Operating System (DOS). Today however it is Windows.

The Operating System is merely in charge of the computer and by itself it really does nothing, instead to get the work done, application programmes are needed. These include word processors, spreadsheets, databases etc.

Other types of programmes include; utilities, games, educational (e.g. typing tutor) and programming software.

LITERATURE SEARCH FROM JOURNALS AND ENCYLOPAEDIA (ON CD-ROM) AND INTERNET

In the conduct of research, literature search is very important. It is the link between the previous work done on the subject and the future outlook or potentials of such research interest.

There are many ways of accessing literature; it can be through the textbook or through journals. Journals are publications of referred articles (peer-reviewed articles), which are usually in the print form and electronic form. The articles in the electronic forms are those articles stored on the computer and can be accessed directly or with access code, which are usually in the form of passwords. The articles can either be stored on the CD-ROM or Internet-based.

CD-ROM

This is known as Compact-disc Read Only Memory, they are discs on which data are stored and read by disc drive using laser at high speed. The disc is very durable and information stored on it cannot be easily overwritten, corrupted or damaged. Quite a number of these information-based software are available e.g. TEAL (The Electronic Agriculture Library), which has thousands of articles along the subject area of Agriculture and allied disciplines. CD-ROM is a means of storing large amounts of information. Several of this device have been produced on various aspects of Veterinary practice such CD Canis, Canid and Phytox.

Internet

Articles can also be accessed through the Internet. The Internet is also known as the World-Wide-Web (www). It refers to the pathway through which information is displayed and or retrieved via global satellite link through access to a variety of computers all over the world. The Internet starts from a single personal computer (or laptop computer) at home or

work, a telephone (for the dial-up system), modem connected to computer and browser software; internet dialler, e.g. internet explorer. To be fully connected, there is the need to purchase connection time from an internet service provider (ISP) who has a server connected to the net. When a user sends a request for information, it goes through the ISP server, which in turn passes the request to the server where the information is stored. The target server then passes the requested information to the original requesting computer through the ISP.

Information can also be accessed through the wire-less system which utilizes the broadband, whereby all that is needed is the computer with the modem and the card.

To view pages on the www, a software package called a browser e.g. internet explorer is needed. To access articles or journals, there is a need for a search machine the most common ones are Yahoo and Google. Google is the most frequently used search machine, it is versatile and user-friendly.

While the Google search machine or indeed Yahoo, have huge data banks, there are some specific search machines dedicated to the field of Medicine and allied Disciplines.

Some Veterinary journals such as the Journal of Small Animal Practice and the Journal of American Animal Hospital Association publish their contents and or abstracts for access over the web. The contents and abstract of these journals is usually available to the browser whenever the site is accessed. Full articles are however often reserved only to online subscribers. The Vet web currently indexes about a thousand, seven hundred Veterinary sites, which are readily available to the user at the touch of the relevant computer keyboard button.

The Internet can also be valuable indirectly the area of the usage of the electronic mail (E-mail). This allows people to communicate with each

other through computer links via the internet. The advantage of using this medium for Veterinarians is that it is instantaneous and has the capacity to have the contents of the mail, such as laboratory results or large amounts of written materials available directly the user.

This medium is also a valuable tool in establishing a consultation system with referral centres and other specialist worldwide.

EPIDEMIOLOGICAL AND STATISTICAL PROGRAMMES

These are programmes designed for use in the fields of Medicine and the Social Sciences.

Epidemiological programmes are useful for the presentation, analysis and interpretation of epidemiological parameters especially for disease monitoring, prediction and forecast, basically to assist in policy formulation.

Statistical programmes are useful in processing results and making meaningful inferences from the result.

There are many epidemiological and statistical packages in use in Veterinary Medicine, while some of them are relatively easy to operate i.e. user-friendly, others are not.

Some of the packages useful in Veterinary Medicine are as follows:

Epi-Info: this is epidemiological programme, it is a software package designed for the Epidemiologists, Public Health practitioners and Researchers. This package provides for easy form of Data-base construction; data entry, sorting, analysis and interpretation. With the **Epi-Info** as the software and the computer as the hardware, the Epidemiologist and other Public Health professionals can rapidly develop questionnaires, form and customize data entry process and analyse data. The primary applications within the **Epi-Info** are:

(a) Make-view: A programme for creating forms or questionnaire which automatically create a database

(b) Enter: A programme for using the forms and questionnaire created in make view to enter data into the database.

(c) Analysis: A programme for producing statistical analysis of data, report, output or graphs

(d) Epi-Map: A programme for creating Geographical Information Map (GIS maps).

(e) Epi-Report: A tool that allows the users to combine analysis, data entry, output and any data contained in accessed data for presentation in a professional form.

SAS : This is a large general purpose package, produced from an original programme that was designed to run on mainframe computer in a batch mode i.e. getting a pile or results in a separate output file.

SPSS: This is known as Statistical Packages for Social Sciences. It is a well-known package particularly popular within the Social Science and the Psychology group of researchers. It is a very robust package capable of performing all the standard analysis.

S-Plus: This is a programme for specialist Statistician basically it is an interactive object-oriented system with both a wide range of built-in function and complete programming capabilities for extending these.

VETERINARY INFORMATION SYSTEM

Computers have become essential tool in almost every field of research and applied technology. The advent of computers allows us as Veterinarians to enter, analyse and store vast amount of data on animal health, production and management, so also be able to adequately handle the administrative responsibilities.

Computer in Veterinary Medicine has been of great value in Veterinary Education, Veterinary Informatics, Veterinary practice, Research as well as Agro-Veterinary consulting services.

Veterinary Information System (VIS) is thus a mechanism for gathering, analysing and transmission of data necessary for the organization and management of Veterinary services as well as Veterinary research. The VIS is useful for the improvement of animal production and control of animal diseases in relation to animal health and public health.

Uses of VIS

1. Assessment and evaluation of need which must be satisfied, this may be individual, corporate, institutional or organizational
2. To plan actions and access the financial resources required
3. Verification of how resources are put to use.
4. Evaluation of results obtained, comparing them with expectations and thus assess the efficacy of the services.
5. Dissemination of data obtained, to government, international agencies, breeder organizations, investors, farmers and the general public at large.

Nature of VIS

1. Epidemiological: this involves the whole body of knowledge concerning health status of animal and the human population including the various interactions therein.

2. Zootechnics: this involves animal population data, including animal nutrition, breeding methods and patterns.

3. Food production/safety/security: this involves the various pathways for transformation/commercialization of food of animal origin.

4. Managerial: this involves human, structural and economic resources available for field, laboratory and administrative activities as well as the operations involved in Veterinary Services.

5. Legislative: this involves principles, law, regulations, decrees etc. regulating the activities of Veterinary Services.

6. Bibliographies: these are technical, scientific documentation such as references, data, papers etc. available on Veterinary Services.

Veterinary Public Health Information System (VPHIS)

The requirements of the Veterinary Public Health (VPH) concerning information centres on the collection of appropriate epidemiological data and other Public Health related information. This is to enable the unit carry out its responsibilities which includes surveillance of food-borne/zoonoses diseases (occurrence and causes) affecting humans, and taking appropriate control measures. The VPHIS is thus important to enable the VPH units do the following:

a) Collect valid epidemiologic and related Public Health data for each of data producing and data generating centre.

b) Classify and record the data in an electronic form (database) so that up to date information is accessible when needed.

c) To analyse and evaluate the information collected, process such as a report and recommendation for problem-solving and decision making.

d) To disseminate information to all possible users of the information locally, regionally and internationally.

Components of VPHIS

There are 2 sub-systems integrated in the VPHIS;

i) The Database sub-system

ii) The knowledge-base sub-system

The integration of the empirical data (from a database sub-system) with the appropriate knowledge-base sub-system is crucial to any problem solving VPHIS. The knowledge-base sub-system is designed to capture pre-existing literature base knowledge electronically and to provide access to such knowledge in a fast and efficient way to assist problem-solving and decision-making task. Such knowledge will normally be obtained from books, journals, reports, proceedings etc. The knowledge based system is updated to provide the most current information.

Primary Sources of Information

The VPH unit can generate empirical data by:

a) Surveillance: this involves inspection activities on food safety (food production systems); food processing and marketing activity.

b) Appropriate periodic or special surveys. Hospitals and Diagnostic Laboratories often serve as first sites where key zoonotic diseases are reported. Field Veterinarians (mainly from the Ministry), private sector (farms or food establishments) may also serve as provider of useful information.

Secondary Sources of Information

a) Report from literature such as annual government report, trade and agricultural productivity report, publications and proceedings dealing with health report pertinent to the state or country.

b) Public sector: by providing avenue of information so that public or consumer will have information of Veterinary Public Health importance

c) International or regional sector: report from the World Health Organisation (WHO), FAO etc.

Disease Modelling for Impact Assessment for Disease Outbreaks

Modelling is the representation of physical processes designed to increase appreciation and understanding of them. It is the representation of events in quantitative mathematical terms, so that predictions can be made about the events.

Disease modelling involves construction of models in an attempt to predict pattern of disease occurrence and what is likely to happen if various alternative control techniques as well as increasing understanding of the life-cycles of infectious agents.

Computers can be used to simulate situations. A model can be utilized effectively only if it is sound. Affirmative answers to the following questions will help to ascertain the validity of the model:

1. Have all the known determinants that influence occurrence of diseases been included?

2. Can the value of these determinants be estimated with accuracy?

3. Does the model make biological "common sense"

Models are basically instruments for making predictions. They cannot stand alone in determining efficient control strategies, but should be used in conjunction with accurate field data and experimental techniques.

Emphasis will be placed on developing a conceptual understanding of the basic methods of modelling and on their practical application rather than the manipulation of mathematical equation.

Types of Models

Veterinary modelling has been directed towards infectious disease, although non-infectious ones can also be modelled.

Infectious agents can be classified into two groups according to their generation dynamics: microparasites (e.g. viruses and bacteria), and macroparasites (e.g. helminths, and arthoropods) and the two different dynamic patterns lend themselves to two different types of modelling.

Density models: consider the absolute number of infectious agents in each host and are commonly used in macroparasitic infections, where numbers of infectious agents can be estimated either in the host or in the environment.

Prevalence models: these are frequently employed in the studies of microparasitic infections and these consider the presence/absence of infections in various host cohorts e.g. young and mature, immune and susceptible.

The density model is potentially the more refined of the two techniques because it attempts to enumerate the number of infectious agents with which a host is challenged.

Deterministic/Stochastic Models

In many models, the values of input parameters can be fixed the results obtained do not take account of uncertainty (i.e. random variations). Such mathematical descriptions are examples of Deterministic models. In contrast, some other models describe process/events subject to random variation so that the outcomes occur with a probability. These models are stochastic. These often enable confidence intervals to be associated with the outputs.

Density and Prevalence models can be formulated deterministically or stochastically using three approaches classifying models:

1) Models using differential calculus
2) Models using simulation
3) Models using matrices and networks

Models using differential calculus

Differential calculus is a mathematical technique for finding small (theoretically infinitesimal) rates of change. Models based on this procedure generally establish equations in terms of rate of change of either the number of parasites, or the number of hosts, or subsets of these populations with respect to time.

Models using simulation

The goal of these models is *simulation* of the performance of parasites or diseases in relation to conditions which change either deterministically or stochastically. The power and success of simulation models have been closely linked to advances in computer technology. There are 3 main types of simulation models:

a) Empirical models
b) Explanatory models
c) Monte Carlo models

Empirical Models

These utilise indicators that are obtained by analysing the relationship between morbidity and any associated variables. Frequently used variables are those relating to climate. These models are not strictly mathematical models because they do not attempt to analyse the dynamics of agents` life-cycle but simply to quantify associated phenomena. E.g. fascioliasis. Considering the life-cycle of its intermediate host F̲ h̲e̲p̲a̲t̲i̲c̲a̲ in small ruminants, two important meteorological factors in the development of the parasite are

temperature and the presence of water. These are the bases on which the simulation models are formed.

Nematodiriasis: whereby the life-cycle of Nematodiriasis *spp.* is temperature dependent. There is a correlation between soil temperature and larval hatching rates. The mean soil temperature at a particular time (month) is used to predict the date of maximum larval count on the pasture.

The two examples given are deterministic models because no consideration is given to random variation.

Explanatory models using simulation

These are mathematical models that describe the dynamics of parasite and host population. These techniques allow the course of disease to be simulated. They include models for forcasting fluke morbidity, the air-borne spread of FMD and the occurrence of clinical ostertagiasis.

Bovine ostertagiasis: the level of pasture contamination by infective O ostertagi level can be predicted by simulating the course of events experienced by various factors associated with the parasite eggs deposited on pasture. These include the developmental stages of the eggs ($L_1 - L_3$), infectivity, fecundity and migratory behaviour of the larva. A prediction of herbage infective larval burdens using this type of simulation model can facilitate optimum use of antihelminthics and movement of animals to safe pasture before challenge by large numbers of infective larvae, thereby preventing clinical ostertagiasis. Similar approach has been successfully applied to tick infestation in sheep.

Monte Carlo methods

Simulation model whereby random processes are simulated using random numbers in order to decide whether or not event takes place.

This is somewhat similar to gambling hence the term "Monte Carlo"simulation. E.g. sheep tick control.

Modelling using Matrices and networks

Matrix and network methods are similar and often the same problem can be formulated using a network and matrix approach. The network formulation is particularly attractive when time delays are a feature of the life-cycle being modelled and when the output response of a biological system is to be measured for a given input.

Matrix formulations on the other hand are attractive when the behaviour of several states of a population is of interest at successive points in time. Matrices often take the form of a rectangular array containing numbers of hosts/parasites in a defined state or stage of development known as the state vector or containing reproduction and survival rates of hosts or parasites in different states or stages known as transition matrix. In this way, it is possible to obtain the state of the system from one point in time to another.

Further Veterinary Applications of Modelling

Models have been developed for the choice of disease control strategies; e.g. for Brucellosis in the UK and USA. Models have also been used to investigate diseases of uncertain aetiology such as Epizootic Bovine Abortion, to model genetic resistance and antigenic drift and to study resistance to anthelminthics and acaricides and the value of identification and recording systems in the control of contagious diseases.

Models that access the cost of disease and its control have also been designed.

As earlier mentioned, it is important to note that modelling in Veterinary Medicine which is also a component of epidemiological approach,

cannot be effectively used without reliable field and experimentally derived data relating to diseases` natural host. When use in association with the above, modelling is a valuable aid to an increased understanding of diseases.

DATABASE APPLICATIONS IN KEEPING OF DIAGNOSTIC AND CLINICAL RECORDS

The advent of the new generation of powerful but robust and inexpensive computers means that Veterinary practitioners now have ample facilities to collate, enter, check, analyze and store vast amount of qualitative data on animal health, production and administrative responsibilities as well as generating reports in the format required for end-users in order to aid management decision making.

Areas of computer application in Veterinary practice can be summarized as follows:

1) Record keeping involving
   a) Clinic
   b) Epidemiological data
   c) Farm records
   d) Abattoir records
2) Laboratory diagnosis
3) Surgery
4) Pharmacy
5) Interaction and learning
6) Entertainment

General Application

There are several areas where computers should be effective in a good and progressive modern Veterinary practice and these include:

- Fee sensitivity elimination

- Perception of value
- Estimating System
- Information generation
    - *Management data*
    - *Medical Data*
- Perception of personal caring
- Organisational systems
- Veterinary Education
- International Veterinary Information Centre (IVIC)
- Research
- Communication
- On-line prescription

Management of Accounts by Use of Spreadsheet

An electronic spreadsheet is a productivity software package that enables the user to create tables and especially financial schedules quickly by entering labels and values into cells on a display screen grid to easily manipulate the numerical data. This is similar to ledger pages divided into columns and rows (called spreadsheets). Businesses have traditionally used spreadsheets to keep track of their financial transactions.

Applications of Spreadsheets

Several electronic spreadsheets have been produced, these include Lotus 1-2-3, Quattro Pro and the most recent and very versatile; Microsoft Excel from Microsoft Inc.

Excel Spreadsheet

This is a program with which one can view, organize, analyze and share data. The software is very user friendly that allows direct data inputting

and importation of data from other applications in order to perform calculations and generate charts/graphs.

Excel uses workbooks and worksheets to record data and do quick calculations.

Database

This refers to tables made of labelled columns that contain specific kind of data e.g. name, age etc. in rows that contain a piece of data from each column.

The Worksheet

This is divided into columns and rows. Each column is identified by letters A – Z, then AA – AZ, BA – BZ etc., which appears in the top border and each row by a number which appears in the left border of the worksheet. The intersection of a specific column and row creates a cell. A cell is a unit of the worksheet that stores data.

Cells are identified by addresses, e.g. the cell in column B row 10 is referred to as cell B10. The number of rows and columns vary among the different spreadsheets. An excel worksheet contains up to 65,536 rows and 260 columns. A workbook is a group of worksheets saved together as a single excel file. When a workbook is saved, all changes made to the worksheet in the workbook are also saved.

In Veterinary practice, a spreadsheet can be used in preparing financial planning e.g. budgets, preparing payrolls of staff, keeping track of revenues and expenditures (cash flow analysis) and keeping tracks of drugs in the pharmacy.