

Scottish Beekeepers' Association

Education and Examination Committee



Syllabus

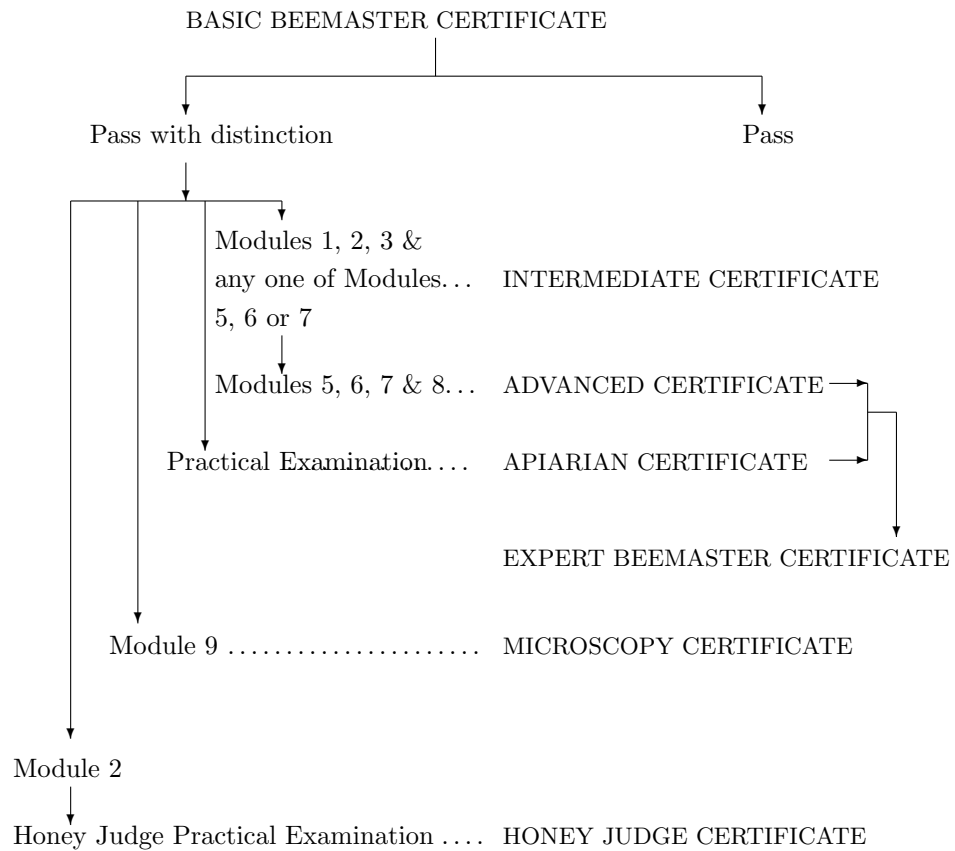
of Examination in Apiculture

Intermediate Certificate

Advanced Certificate

Expert Beemaster Certificate

THE SCOTTISH BEEKEEPERS' ASSOCIATION
EXAMINATION STRUCTURE



ACKNOWLEDGEMENT

The modules in this prospectus have been written by members of the BBKA Examinations Board.

BBKA and SBA recognise that there is a need to harmonise their examination syllabuses and assessment standards.

With this in mind, BBKA has agreed that the SBA should use the same modular content, while still preserving its autonomy in examination structure and issue of awards.

The Scottish Expert Beemaster Certificate is recognised by the Examination Board for the National Diploma in Beekeeping as a qualification for entry to the NDB examination.

Research areas	Names
Swarming, spring feeding	J. Simpson
Bee behaviour	Ribbands, Rosch, Von Frisch, Lindauer, Gould
Mating outside hive	Huber, J. Janscha, Beowulf Cooper
Parthenogenesis	J. Dzierzon
Pheromones	Dr. C. Butler, Dr. J. Free

7. Candidates, who have passed the SCOTTISH BEEMASTER EXAMINATION, with distinction, and MODULE 2, will be eligible to apply for the SCOTTISH HONEY JUDGE PRACTICAL EXAMINATION.

8. Parts of these modules will comprise the syllabus for the ORAL EXAMINATION for the SCOTTISH APIARIAN CERTIFICATE.

Influential authors	Texts
Rev. Charles Butler	The Feminine Monarchie
Rev. W. C. Cotton 1842	My Bee Book
F. R. Cheshire 1886	Bees And Beekeeping
Dr. T. W. Cowan 1881	British Beekeeping Guidebook
W. Herrod-Hempsal	British Beekeeping Guidebook + other texts
A. I. Root (US) 1977	ABC of Bee Culture
Rev. L. Langstroth	The Hive and the Honeybee
Dr. J. Free	Several texts
Brother Adam	In Search Of The Best Strains Of The Honeybee + other texts
Dr. Eva Crane	Several Major Texts
E. B. Wedmore	A Manual of Beekeeping
R. O. B. Manley	Honey Farming
Ted Hooper	Guide to Bees and Honey, Encyclopedia
Dr. M. Winston	The Biology of the Honeybee
K. von Frisch	The Dance Language and Orientation of Bees
M. Lindauer	Communication Among Social Bees
J. Gould and C. Gould	The Honeybee

9. Candidates who have attained the SCOTTISH ADVANCED CERTIFICATE will be exempt from the ORAL EXAMINATION for the SCOTTISH APIARIAN CERTIFICATE.

THE EXAMINATION

1. The examination venue and invigilation shall be arranged by the Education Committee. The venue shall be near the candidate's home. Arrangements shall be made in good time in consultation with the candidate.
2. The examination for each module shall consist of a written paper to be answered in 1½ hours.
3. Two examiners shall mark each module independently. The marks awarded shall be scrutinised by a moderator.
4. After moderation, the Examination Secretary shall inform each candidate, by letter, of the examination result.

Hives	Names
Collateral hive	Rev Stephen White 1756, Thomas Nutt
Leaf hive	Huber (Switz)
Stewarton	Robert Kerr 1819
First movable frame hive in UK	T. W. Woodbury 1862
First Double walled hive	T. W. Cowan
WBC	W. B. Carr 1890
Langstroth and bee space	Rev L. Langstroth 1851
Dadant	Dadant
Commercial (16×10)	Simmins
Smith	Smith
Catenary	Bill Bielby
British National and Modified National	Evolved from various sources

Introduction of Beekeeping Equipment	Names
Queen excluder	Abbé Colin (Fr)
Smoker	Moses Quinby, T. F. Bingham
Bee escape	E. C. Porter 1891 (US)
Frame spacing	W. B. Carr (metal ends), Hoffmann, Mar
Wax foundation	J. Mehring 1857 (Germany), E. B. Weed
Wired frames	Capt. Hetherington
Extractor	Major Von Hruschka, T. W. Cowan
Feeder	Miller, Ashforth
Queen introduction cage	Dr. Colin Butler
Swarm control board	Snelgrove

Introduction of bee strains to the UK	Names
Intro of Italian bees	T. W. Woodbury 1859
Intro of Carniolan	W. C. Cotton 1870
Intro of Cyprian	T. B. Blow 1887
Development of Buckfast strain	Br. Adam

Development of beekeeping methods	Names
Swarm control	Snelgrove, Taranov, Pagden
Queen rearing	Miller, Doolittle
Two queen system	G. Wells 1894
Bailey comb change	Dr. L. Bailey
Moveable bar combs	George Wheeler (introduced idea from G
Bee space	Rev. L. Langstroth

Founding of important organisations	Name
Founding of BBKA	T. W. Cowan, C. N. Abbott
Founding of Scottish Beekeepers' Association	G. W. Avery 1912
Founding of the Moir Library (Scotland)	John Moir 1912
Founding of BBJ	W. B. Carr, T. W. Cowan, C. N. Abbott
Founding of E. H. Taylor Ltd	T. B. Blow
Founding of I.B.R.A.	Dr Eva Crane
Founding of BIBBA	Beowulf Cooper

A guide to help candidates prepare for 8.23 and 8.26.

History of beekeeping

MODULE 1

HONEYBEE MANAGEMENT

The candidate shall be able to give a detailed account of:-

- 1.1 the types of hives and frames used by beekeepers in the United Kingdom, including comparative knowledge of frame sizes of the following hives: National, WBC, Smith, National Deep, Commercial, Langstroth and Dadant. **Exact frame sizes are not required;**
- 1.2 the principles which govern the design of hives and frames, including the concept of bee space, and the main features of their construction;
- 1.3 the use of wax foundation and how it can be made on a small scale;
- 1.4 methods of fitting frames with **wired and unwired** foundation, **including wiring a frame;**
- 1.5 the methods of spacing frames in hives, the usual measurements used and the advantages and disadvantages of varying the spacing;
- 1.6 how to begin beekeeping, including the acquisition of bees, sources **and type of personal and other** equipment, **the approximate costs of equipment and bees** and any precautions necessary;
- 1.7 the criteria used in the selection of apiaries;
- 1.8 the factors to be considered in the siting of colonies in home and out-apiaries;
- 1.9 good apiary hygiene;
- 1.10 the variable temperament of bees in relation to management and public relations;
- 1.11 the actions which can be taken to avoid bad-tempered bees causing a nuisance to members of the public;
- 1.12 the year's work in the apiary and how this is dependent upon the annual colony cycle and the timing of local bee forage;
- 1.13 the drifting of honeybees, the dangers caused and techniques used to minimise the problem;
- 1.14 the principles involved in feeding honeybees, including types of feeder, amounts of food, types of food and timing of feeding;
- 1.15 the value of honey, pollen, **water and propolis** to the honeybee colony;
- 1.16 the prevention, detection and control of swarming;
- 1.17 the use, and types, of queen excluder used in the United Kingdom;
- 1.18 **methods** of swarm control used in small-scale beekeeping enterprises;
- 1.19 **methods of marking and clipping queens;**

- 1.20 the methods of making nuclei and the uses to which nuclei can be put;
- 1.21 how swarms and nuclei can be turned into productive colonies;
- 1.22 methods of taking and hiving a swarm of honeybees;
- 1.23 the methods used to unite colonies of honeybees, the underlying principles of these methods and any precautions that should be taken;
- 1.24 robbing by honeybees and wasps and the associated dangers, including prevention and curtailment;
- 1.25 spring management of honeybee colonies;
- 1.26 management of honeybee colonies for honey production from oil seed rape **and other specialist crops such as heather**;
- 1.27 summer management of honeybee colonies;
- 1.28 moving colonies and the difficulties and dangers involved;
- 1.29 different methods of 'clearing' bees from supers;
- 1.30 how colonies are prepared for the winter period and the principles underlying this preparation;
- 1.31 the effect of honeybee stings and recommended first aid treatment;
- 1.32 laying workers and drone laying queens and the conditions leading to their development;**
- 1.33 the signs of queenlessness and a method of confirming the condition.**

- 8.15 the use of honeybees as pollinators in orchards and fields of seed crops including arrangements to be made with the farmer/grower;**
- 8.16 the management needed to cope with geographic localities, weather conditions and the timing of the flowering of forage plants;**
- 8.17 methods of swarms control suitable for use in small and large beekeeping enterprises;**
- 8.18 the setting up and management throughout the season, of an observation hive, and the uses to which it can be put;**
- 8.19 the preparation of a risk assessment and safety policy relating to the handling, demonstrating and showing of live honeybees;**
- 8.20 methods of monitoring and seasonal management of the health of colonies;**
- 8.21 the signs of disease and pest infestations of honeybees; the potential impact on bee health, the economic effect and how these diseases and pest infestations impact on the management of the colony;**
- 8.22 procedures related to good hygiene practices on matters of personal clothing, manipulations and equipment to prevent the spread of diseases between colonies and between apiaries;**
- 8.23 the development of hives and beekeeping equipment used in the United Kingdom (refer to list in Appendix);**
- 8.24 the life histories of one selected species of each of the following found in the United Kingdom: solitary bee, social bee (other than *Apis mellifera*), solitary wasp and social wasp, and their interaction with honeybees.**

The Candidate will be able to give an outline account of:–

- 8.25 the history of beekeeping through leading contributors (listed in Appendix) to the knowledge of honeybees and beekeeping practices.**

HONEYBEE MANAGEMENT AND HISTORY

The Candidate is expected to have a broad based knowledge of beekeeping.

The Candidate shall be able to give a detailed account of:-

- 8.1 the assessment of the quality of a colony for honey production;
- 8.2 the management of colonies for the production of oil seed rape (*Brassica spp.*) and ling heather (*Calluna vulgaris*) honey, the techniques involved in overcoming problems associated with extracting these honeys;
- 8.3 the management of colonies for the production of comb honey (sections and cut-comb) and its preparation and presentation for sale;
- 8.4 the properties of honey including specific gravity, refractive index, viscosity, hygroscopicity, electrical conductivity, reactions to heat and ageing;
- 8.5 the process of honey crystallization including factors that affect its speed, crystal size, and the texture of the final product;
- 8.6 the preparation and bottling of liquid honey and set honey, including the requirement of the current UK statutory regulations relating to hygiene, handling, bottling, composition, labelling and weights of packs of honey;
- 8.7 the identification of pollen grains by their colour, size, specific shape and structure, using named examples, and an outline of the technique of melissopalynology to determine the floral source(s) and geographic origin of honey samples;
- 8.8 the nutritional value of honey to the honeybee colony;
- 8.9 the main constituents and physical properties of beeswax and propolis;
- 8.10 the commercial manufacture of wax foundation;
- 8.11 the production and use of pollen supplement and pollen substitutes;
- 8.12 the assessment of the qualities of a queen and her colony and their subsequent management for queen rearing;
- 8.13 the structure and changes in function of the exocrine glands throughout the life of the castes of a honeybee colony, and the implications this has for the management of a honeybee colony;
- 8.14 the management of colonies used for migratory beekeeping for both honey production and pollination services;

HONEYBEE PRODUCTS AND FORAGE

The candidate shall be able to give detailed accounts of:-

- 2.1 the main requirements of the current United Kingdom statutory regulations affecting the handling, preparation for sale, **hygiene**, composition, labelling and weight of packs of honey;
 - 2.2 the methods used to uncap honeycombs, and of separating the cappings from honey;
 - 2.3 the types of honey extractor available and their use in the extraction of honey including ling heather honey from combs;
 - 2.4 the straining and settling of honey after extraction;
 - 2.5 the storage of honey including the underlying principles of storage;
 - 2.6 the preparation and bottling of liquid honey, including ling heather honey;
 - 2.7 the preparation and bottling of naturally granulated, soft set and seeded honey;
 - 2.8 the preparation of section, cut-comb and chunk honey for sale;
 - 2.9 the constituents, expressed in percentage terms of a typical sample of United Kingdom honey and an outline of the normal range of variation of its main constituents;
 - 2.10 methods of determining the moisture content of honey;
 - 2.11 the spoilage of honey particularly by fermentation (including the effect of water content, storage temperature and the presence of yeast);
 - 2.12 the physical properties of honey including relative density (specific gravity), refractive index, viscosity, hygroscopicity and reaction to heat **and electrical conductivity**;
 - 2.13 the main constituents and physical properties of beeswax;
 - 2.14 methods of recovering saleable beeswax from used comb and cappings;
 - 2.15 the range of uses for, and preparation of, beeswax;
 - 2.16 the uses of other bee products such as pollen, royal jelly, venom and propolis;
 - 2.17 the preparation of comb honey, soft set, naturally set and liquid honey, beeswax blocks, beeswax candles and meads for the show bench.
- The Candidate shall also be able to give:-
- 2.18 a list of 10 major nectar and/or pollen producing plants of the United Kingdom and their flowering periods together with a detailed knowledge of those in his/her own locality;
 - 2.19 **an account of the information that the following flowers communicate to the honeybee — clover, field geranium, forget-me-not, horse chestnut;**

- 2.20 an illustrated description of the floral structure of apple;
- 2.21 **an account of the process of pollination and fertilisation;**
- 2.22 the genetic and evolutionary importance of cross-pollination and an outline of the methods used by plants to favour cross-pollination;
- 2.23 **the location and function of the extra-floral nectaries of broad bean, cherry laurel, cherry and plum;**
- 2.24 a list of floral sources of unpalatable honey;
- 2.25 an account of the composition of nectar and its variants;
- 2.26 an account of the factors affecting nectar secretion and the variations in the composition of nectar in different plant species and differing weather conditions;
- 2.27 an account of the origins and typical composition of honeydew with a brief description of the characteristics of honeydew honey;
- 2.28 an account of how the worker honeybees process nectar to change it into honey, **including the enzymes and chemistry involved (to include a chemical equation);**
- 2.29 **an outline account of the determination of the floral source(s) and geographic origin of honey by analysis of its pollen content and the use of such information in the enforcement of regulations governing the labelling of honey offered for sale.**

- 7.17 describe the signs of queenlessness and how this may be confirmed;
- 7.18 give a detailed account of methods of marking and clipping queens and the advantages and disadvantages of these practices;
- 7.19 distinguish between queen cells produced under the emergency, supercedure and swarm impulses;
- 7.20 give an account of the problems inherent in cross-breeding subspecies of honeybee;**
- 7.21 give an account of the advantages and disadvantages of inbreeding and out breeding and how it can be assessed;**
- 7.22 give an account of the effect of pathogens and pests on bee breeding.**

SELECTION AND BREEDING OF HONEYBEES

The candidate shall be able to:-

- 7.1 give the principles of the selection of breeder queens and drones;
- 7.2 describe a system of record keeping used in the assessment of queens and their progeny;
- 7.3 give a detailed account of methods of queen rearing suitable for a bee-keeper with five to ten colonies and methods more suitable for large scale queen rearing operations;
- 7.4 give an outline account of a method of instrumental insemination and assess the role this technique could play in honeybee breeding;
- 7.5 give a detailed account of methods of queen introduction, the principles underlying the processes involved, the precaution to be taken, and the attendant difficulties in relation to different strains of bee and colony condition;
- 7.6 describe the setting up of mating nuclei and any precautions that need to be taken;
- 7.7 give an account of the **subspecies** and strains of honeybee commonly used by beekeepers in Europe with particular reference to their appearance and behavioural characteristics;
- 7.8 **give an account of the important aspects of the behaviour of honeybees, in relation to breeding programmes;**
- 7.9 show an understanding of Mendelian genetics, particularly the inheritance of one gene with two alleles, and the concept of multiple alleles;
- 7.10 **give an outline account of inheritance in the honeybee;**
- 7.11 describe the genetic basis of sex determination in the honeybee including parthenogenesis;
- 7.12 give an account of mitosis and meiosis showing an understanding of the unusual nature of meiosis in the drone honeybee;
- 7.13 describe in detail the reproductive system of the queen and drone with an outline account of sperm and egg production;
- 7.14 give a detailed account of the mating behaviour of honeybee queens and drones including the roles of pheromones and the concept of drone congregation areas;
- 7.15 describe the causes of drone laying queens and laying workers and ways to recognise the presence of these in a colony;
- 7.16 describe ways of dealing with colonies with laying workers and drone laying queens;

HONEYBEE DISEASES, PESTS AND POISONING

The candidate shall be able to give:-

- 3.1 a detailed account of the field diagnosis of American foul brood (AFB) and European foul brood (EFB), including lateral flow devices and a detailed account of the signs of these two diseases;
- 3.2 an account of the life cycle of the causative organisms of AFB and EFB and their development within the larvae;
- 3.3 a detailed account of the development of AFB and EFB within the colony;
- 3.4 a detailed account of the ways in which AFB and EFB are spread from one colony to another;
- 3.5 a detailed account of the authorised treatment of colonies infected with AFB and EFB including methods of destruction of colonies and the sterilisation of equipment;
- 3.6 a detailed account of the statutory requirements relating to **notifiable diseases and pests** and the implementation of these requirements in the United Kingdom;
- 3.7 **an account of the statutory requirements relating to the importation of honeybees;**
- 3.8 a description of the life cycle and natural history of *Varroa destructor* including its development within the honeybee colony and its spread to other colonies;
- 3.9 a detailed account of the signs of Varroosis describing methods of detection and ways of monitoring the presence of the varroa mite in honeybee colonies;
- 3.10 a detailed account of methods of treatment and control, including Integrated Pest Management (IPM) and an outline of the consequences of incorrect administration of chemical treatments, together with a way of determining the resistance of Varroa to such treatments;
- 3.11 a detailed account of the cause, signs and treatment (if any) of adult bee diseases currently found in the United Kingdom: these diseases to include Nosema, Dysentery, Acarine and Amoeba;
- 3.12 **a simple account of the structure and function of the alimentary, excretory and respiratory systems of the adult honeybee and of the life cycle of the causative organisms of adult honeybee diseases;**
- 3.13 a detailed account of the cause, signs and treatment (if any) of the following brood diseases and conditions:- chalk brood, sacbrood, chilled brood, bald brood, neglected drone brood and stone brood;
- 3.14 a detailed account of the authorised treatments for adult bee disease in the UK;

- 3.15 a detailed account of the laboratory methods of diagnosis of Acarine, Nosema and Amoeba diseases in worker honeybees;
- 3.16 a detailed description of the fumigation of combs using ethanoic acid (acetic acid), including safety precautions to be taken;
- 3.17 a description of the effects of Chronic bee paralysis (both syndromes), **acute bee paralysis virus, black queen cell virus**, sacbrood and deformed wing viruses together with an elementary account of the effects of other viruses affecting honeybees including their association with other bee diseases **and pests** where applicable;
- 3.18 the scientific names of the causative organisms associated with diseases of honeybees;
- 3.19 an outline account of the life cycle of *Braula coeca*, its effect on the colony and a description of the differences between adult *Braula* and *Varroa*;
- 3.20 an outline account of the signs of poisoning by natural substances, pesticides, herbicides and other chemicals to which honeybees may be exposed;
- 3.21 an account of the ways in which honeybees can become exposed to agricultural and pest control chemicals;**
- 3.22 a detailed description of the action to take, and practical measures possible, when prior notification of application of toxic chemicals to crops is given;
- 3.23 an outline description of a spray liaison scheme operated by a beekeeping association;
- 3.24 an account of the action to be taken when spray damage is suspected;
- 3.25 a description of the damage caused to colonies and equipment by mice, woodpeckers and other pests and ways of preventing this;
- 3.26 a detailed account of wax moth damage and the life cycle of both the Lesser and Greater wax moth (*Achroia grisella* and *Galleria mellonella*);
- 3.27 a detailed account of methods of treating or storing comb with particular reference to preventing wax moth damage.

- 6.19 laying workers and drone laying queens and the conditions leading to their development;**
- 6.20 the effects of pathogens and pests on bee behaviour;**
- 6.21 the learning behaviour of honeybees;**

MODULE 6

HONEYBEE BEHAVIOUR

The candidate shall be able to give a detailed account of:-

- 6.1 the function and behaviour of the worker honeybee throughout its life including the types of work done, duration of work periods under normal circumstances and the variation in behaviour due to seasonal changes in the state of the colony;
- 6.2 the mating behaviour of the honeybee queen and drone including an account of the pheromones involved and the concept of drone congregation areas;
- 6.3 the queen honeybee's egg laying behaviour and its relationship to changing circumstances in the hive and external factors relating to climate and season;
- 6.4 the seasonal variations in the population size of a honeybee colony and an explanation of such variations;
- 6.5 the social organisation of the honeybee colony **including worker policing**;
- 6.6 the methods of communication used by the honeybee including food sharing (**trophallaxis**), dancing, scenting and vibration;
- 6.7 the behaviour of the foraging bee and its work methods in the field including orientation;
- 6.8 the behaviour of the worker bee towards intruders and the theories advanced to describe the means by which colonies recognise intruders;
- 6.9 the collection of nectar and water and their use by the colony;
- 6.10 the inter-relationship of nectar, honey and water in the honeybee colony;
- 6.11 the conversion of nectar to honey including the **hydrolysis** of sucrose, the evaporation of water, and the role of the honeybee in accomplishing these changes;
- 6.12 the collection, storage and use of pollen by the honeybee colony;
- 6.13 the collection and use of propolis by the honeybee colony;
- 6.14 the conditions leading to swarming;
- 6.15 the conditions leading to supersedure;
- 6.16 the behaviour of swarms and the method of selection by the swarm of a site for a new home;
- 6.17 the initiation of comb building and the construction of comb;
- 6.18 the colony in winter and summer with special reference to ventilation, humidity and temperature control (**homeostasis**);

MODULE 4

DISCONTINUED

MODULE 5

HONEYBEE BIOLOGY

The candidate shall be able to describe in detail and illustrate where appropriate, referring to histological features as necessary:–

- 5.1 the alimentary system including the process of digestion by enzymes and the absorption and assimilation of the products of digestion;
- 5.2 the excretory system and the substances excreted;
- 5.3 the respiratory system, including the muscular ventilation of the air sacs, the structure and operation of the spiracles and the exchange of respiratory gases;
- 5.4 the circulatory system, including the heart, dorsal and ventral diaphragms and the composition and functions of haemolymph;
- 5.5 **the exocrine glands of all castes and sexes of adult bees and larvae, the functions and main compositions of their secretions including pheromones**, (hypopharyngeal, mandibular, **tergite glands of the queen (Renner-Baumann)**); Nasonov, sting, Arnhart post cerebral, thoracic salivary, wax glands and wax production);
- 5.6 the structure and function of the nervous system and sense organs (including the compound eyes, ocelli, organ of Johnston and the sensilla);
- 5.7 the endocrine glands and the functions of their secretions **particularly the neurosecretory cells, the corpora allata, corpora cardiaca and the prothoracic glands**;
- 5.8 the fat body and its storage of metabolites;
- 5.9 the reproductive system of queen and drone and the production of sperm and eggs;
- 5.10 the structure of the egg, development of the embryo within the egg and the hatching of the larva;
- 5.11 the external and internal structure of the honeybee larva;
- 5.12 the metamorphosis of the larva with outline accounts of ecdysis, larval defecation, cocoon spinning, the external anatomy of the pro-pupa, its change to a pupa and then to an imago;
- 5.13 the effect of feeding **and other factors** on caste determination **including** discussion of the differences between brood food and royal jelly;
- 5.14 the physiological and structural differences between laying workers and normal workers and the role of pheromones in bringing about these differences;
- 5.15 the differences between summer and winter worker honeybees;
- 5.16 the structure and main constituents of the cuticle with an outline account of its invagination within the body to form linings of the gut and tracheae;

- 5.17 the external anatomy of the queen, worker and drone;
- 5.18 the function and structure of the wings, legs, **feet**, antennae, mouth parts and setae (hairs);
- 5.19 the structure of the sting mechanism and how this mechanism operates to penetrate human skin and deliver the venom;
- 5.20 the role of direct and indirect muscles in flight.