

**UNIVERSITY OF MUMBAI**  
No. UG/2017 of 2017-18

2

**Circular:-**

The Principals of the Affiliated Colleges in Science and the Directors of recognized Science Institutions concerned are hereby informed that in continuation syllabi relating to Bachelors of Science (B.Sc.) degree Course passed by the Academic Council at its meeting held on 27<sup>th</sup> February, 2013 vide item no. 4.45 and recommendations made by the Board of Studies in Zoology at its meeting held on 9<sup>th</sup> May, 2017 has been accepted by the Academic Council at its meeting held on 11<sup>th</sup> May, 2017 vide item no. 4.232 and that in accordance therewith, the revised syllabus as per the (CBCS) of T.Y.B.Sc. Economic Entomology (Applied Component) (Sem. V & VI) which is available on the University's website ([www.mu.ac.in](http://www.mu.ac.in)) and that the same has been brought into force with effect from the academic year 2017-18.

MUMBAI - 400 032  
21<sup>st</sup> August, 2017

  
REGISTRAR

To,

The Principals of the Affiliated Colleges in Science and the Directors of recognized Science Institutions concerned.

**A.C/4.232/11.05.2017**

No. UG/2017 -A of 2017 MUMBAI-400 032 21<sup>st</sup> August, 2017

Copy forwarded with Compliments for information to:-

- 1.The Co-ordinator, Faculty of Science & Technology,
- 2.The Offg.Director, Board of Examinations and Evaluation,
- 3.The Director, Board of Students Development.,
- 4.The Professor-cum-Director, Institute of Distance and Open Learning.
- 5.The Co-Ordinator, University Computerization Centre,

  
REGISTRAR

P.T.C

**AC - 11<sup>th</sup> May, 2017**  
**Item No. 4.232**

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Item No. 4.232

AC Item No.

# UNIVERSITY OF MUMBAI



**Program: B.Sc.**

(Credit Based Semester and Grading System)

**Course: Economic Entomology**  
(Applied Component)

**Syllabus for Semester V & VI**

(with effect from the academic year 2017-18)

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## **PREFACE**

Applied Component was introduced for T. Y. B. Sc. class in the academic year 1979-80 with a view to enhance the essence for employability. The syllabus is a blend of concepts with four electives. It gives me immense pleasure to present these four applied component courses namely Marine Science, Fishery Biology, Economic Entomology and Environmental Science under the umbrella of BOS in Zoology.

In the syllabi of these applied components, applied topics having commercial propositions have been incorporated that further ads to the enhancement of entrepreneurial potential and skills amongst the learners. In the past our syllabus focused mainly on theory as a way of providing knowledge base and preparation for students. We have attempted to go beyond this tradition, while doing so, equal emphasis is laid on theory and corroborative practicals. From the academic year 2011-12, the University has introduced Credit Based Semester and Grading System (CBSGS). Accordingly the existing syllabi of these applied components were restructured to fit into the CBSGS pattern. The concept of flexi syllabus was introduced offering opportunity to learners to study any four out of a total of eight units in each course. Now that the syllabus is restructured and to be introduced from the academic year 2017-2018, we have included a novel concept of open unit and case studies. This approach, I'm sure will enhance the critical and analytical thinking abilities of the students.

I take this opportunity to thank the experts in various fields for giving valuable, beneficial and constructive suggestions during framing of the syllabus. The syllabus committee under the convenership of Mr. VinayakDalvie has done a commendable job of timely framing the syllabus with a highest degree of precision and accuracy. While appreciating the efforts, I also express my thanks and heartfelt gratitude to the entire team.

– Dr. Anita Jadhav  
Chairperson,

Ad-hoc BOS in Zoology

### **PREAMBLE**

As a convener when I mooted the concept of flexi-syllabus, first of its kind, in the academic year 2009-10 it was grossly misconstrued. To add to it I also placed an idea of including case studies and introducing a new concept of 'Open Unit'. Both were rejected then. I had also proposed a new subject 'Entrepreneurial and Industrial Biology' in place of the existing Applied Components usually offered by the students of Biological Sciences. Twenty workshops in different districts with teachers and students of various subjects were conducted to explain these four concepts. A twenty one days refresher course for teachers, sponsored by UGC was also conducted in the new subject of 'Entrepreneurial and Industrial Biology' which was much appreciated by the then Director of NAAC, Prof H. A. Ranganath, who is from Biological Sciences, understanding the potential of the subject. However, implementation was postponed for technical reasons thus permitting innovation limited to the flexi-syllabus, implemented in 2010-11, which has inherent capacity to cater to the diverse needs of the region and the industry by allowing students and teachers to choose a desired capsule of eight topics, with various permutations and combinations from the menu of sixteen based on the interest, resources, expertise and need. It took care of a range of students by also providing learners' space to high IQ students. Yet the possibility of exclusion of some important topics cannot be ruled out apart from some new avenues developed during the lag phase of revision of syllabi. Open unit will permit a good teacher to keep pace with the development and adopt latest topics instantly without waiting till it becomes obsolete in the gap of 5 years that the University generally takes to revise the syllabus. It may also allow students to learn the existing topic in more details and depth under the open unit thus making them specialized in need based areas enhancing employability. Assignments would add to their understanding of Government schemes, regulations and market, while projects will augment Business Sense or Scientific Acumen, as the case may be. Case studies and simulations, introduced for the first time in Zoology, would pose challenge for true application of knowledge to real life situations with thought provoking questions demanding analytical solutions. Pedagogy of such dynamic syllabus will range from use of ICT in the class to teaching directly in the field with a blend of participative and experiential learning with group dynamics gaining true knowledge apart from developing personality of the students and above all making them apply 'Common Sense' which is the essence of life. I am sure dedicated team of Zoologists which has placed the subject on top in the past 5 years is poised to make it a success in every college befitting the purpose of introducing applied component by the University in the academic year 1979-80.

- VINAYAK DALVIE  
Convener,

**AC - 11<sup>th</sup> May, 2017**  
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Syllabus Committee

**PEDAGOGY**

Understanding the potentials of flexi-syllabus, it is important to select four units in each semester systematically having relevance with each other. Through permutations and combinations, one may develop different capsules, each being a subject itself. For e.g. by selecting unit I, IV, V and VIII in Semester V and unit IV, V, VI and VII in Semester VI, into entrepreneurship specialization is taught.

Of course, each one has the liberty to choose any course of the subject, any four units in each semester in consultation of with student's needs, expertise & other resources available. It is recommended to make use of ICT, show short films, You-tube videos, documentaries, etc. regularly to make the subject interesting, however field trips/study tour/ Industrial visit both short and long are recommended relevant to the units prescribed whether selected for teaching or not, for providing desired exposures.

It is highly recommended that units such as unit V (Semester V) and unit I (Semester VI) will not be taught in the classroom but in the field for experiential learning. Case studies need to be taught through group discussion in a group of 10 each for every case developed and presented by the teacher with thought provoking approach expecting students to think analytically, deriving solutions after critical evaluation in the group.

Open unit can be most effectively used by a creative teacher by coining topics giving further in-depth knowledge on need based topics covered in the syllabus. Teacher also has a liberty to include a newly developed area due to an arising need in the vicinity under open unit with consent of Head of department and the Principal. The syllabus has a few theoretical topics though most of the topics otherwise are applied.

Lastly, it is advisable to search for government and non-government funding agencies viz, Nationalized banks, DIC, NABARD, KVIC, STARTUP INDIA, STANDUP INDIA which offers subsidized loans for agriculture supporting projects. To understand commercialization of bio-industrial projects, feasibility report should be well understood. Students could be trained practically to establish 'butterfly garden' in metropolitan cities. Of course, the fact remains being applied component it has limitation of the scope.

Co-Conveners,  
Syllabus Committee.



T. Y. B. Sc.  
Credit Based Semester and Grading System  
**Economic Entomology (Applied Component)**  
**Syllabus**  
(to be implemented from the academic year 2017-2018)  
**Semester V**

**Applied Entomology**

<b>Theory</b> (Any four units to be opted)				
<b>Course</b>	<b>Unit</b>	<b>Topic</b>	<b>Credits</b>	<b>L / Week</b>
<b>USACEENT5 01</b>	<b>1</b>	Systematics of Insect	<b>2</b>	<b>4</b>
	<b>2</b>	Morphology, Anatomy and Physiology of useful Insects		
	<b>3</b>	Anatomy and Physiology of harmful Insects		
	<b>4</b>	Agro-support and Conservation of Insects		
	<b>5</b>	Apiculture		
	<b>6</b>	Sericulture		
	<b>7</b>	Lac culture		
	<b>8</b>	Case Study and Simulation		
<b>Practical</b>				
<b>USACEENT5 P1</b>	Practicals based on Course <b>USACEENT501</b>		<b>2</b>	<b>4</b>

**Semester VI**  
**Commercial Entomology**

<b>Theory</b> (Any four units to be opted)				
<b>Course</b>	<b>Unit</b>	<b>Topic</b>	<b>Credits</b>	<b>L / Week</b>
<b>USACEENT601</b>	<b>1</b>	Integrated Pest Management (IPM), Organic and Biological pest control in Agriculture	<b>2</b>	<b>4</b>
	<b>2</b>	Chemical Pest Control in Agriculture		
	<b>3</b>	Urban and Domestic Pest Control		
	<b>4</b>	Neo-avenues in Entomology		
	<b>5</b>	Government Schemes		
	<b>6</b>	Finance		
	<b>7</b>	Sales and Marketing		
	<b>8</b>	Open unit		
<b>Practical</b>				
<b>USACEENT6P1</b>	Practicals based on Course <b>USACEENT601</b>		<b>2</b>	<b>4</b>

**Applied Entomology**  
**Course code: USACEENT501**  
(Any 4 units to be opted)

Lectures 60  
Credits 2

**Unit 1: Systematics of Insects**

**Objective:**

- *To introduce classification of insects up to order level.*
- *To enable learners to categorize insects on the basis of morphological characteristics.*

**Desired outcome:**

- *Learner would be able to classify insect up to their respective orders.*
- *Learner would understand basis of classification.*

1.1 Classification of insects

1.1.1 Insect classification.

1.1.2 Broad characteristics with examples (Minimum 3 of each order except Thysanura)

- a) Thysanura, Orthoptera, Isoptera
- b) Hemiptera, Lepidoptera, Diptera
- c) Hymenoptera, Coleoptera, Odonata

**Unit 2: Morphology, Anatomy and Physiology of useful Insects**

**Objective:**

- *To introduce the morphology of typical insect*
- *To study the general anatomy and physiology of specific useful and harmful insects.*

**Desired outcome:**

- *Learner would understand the basic body plan of insects.*
- *Learner would be able to understand the difference in the life cycles of insects.*
- *Learner would understand various physiological aspects in insect with their speciality of usefulness and harmfulness.*

2.1 General morphology and development of insects

2.1.1. External morphology of a typical insect.

2.1.2. Types of metamorphosis.

2.1.3. Types of larvae and pupae.

2.2 General anatomy and physiology of insects

Brief out line of digestive system, respiratory system, circulatory system, reproductive systems - male and female, excretory system, nervous system, endocrine system.

2.3 Anatomy and physiology of useful insects

- a) *Apis spp.* (Honey bee)
- b) *Bombyx spp.* (Silk moth)
- c) *Tachardialacca* (Lac insect)

### Unit 3: Anatomy and Physiology of Harmful Insects

#### Objective:

- *To study the various systems of harmful insects.*
- *To study the different life processes of harmful insects.*

#### Desired outcome:

- *Learner would understand about anatomy of typical harmful insects.*
- *Learner would understand life processes of certain harmful insects.*

#### 3.1. Anatomy and physiology of harmful (with respect to agriculture) insects.

- a) *Schistocera spp.* (Grasshopper)
- b) *Aphis spp.* (Aphids)
- c) *Formica rufa* (Ants) / *Dysdercus spp.* (Red cotton bug) / *Thripstabaci* (Thrips)

#### 3.2. Anatomy and physiology of harmful (with respect to human) insects.

- a) *Anopheles/Culex/Aedes spp.* (Mosquito)
- b) *Phlebotomus spp.* (Tsetse fly)
- c) *Muscadomestica* (House fly)

#### 3.3. Anatomy and physiology of harmful (with respect to animal husbandry) insects

- a) *Tabanus bovines* (Horse fly)
- b) *Dermatodiahominis* (Bot fly)

### Unit 4: Agro-support and Conservation of Insects

#### Objective:

- *To study the versatile roles of insects in agriculture.*
- *To survey the various strategies of insect conservation.*

#### Desired outcome:

- *Learner would understand the various ecological importance of insects.*
- *Learner would be able to construct butterfly gardens.*
- *Learner would understand need for conservation of insects.*

#### 4.1 Agro-supportive role of insect

4.1.1. Insect as a pollinator: *Apis spp.* (honey bee), *Bombusterrestris* (bumble bee), *Drosophila spp.* (fruit fly), *Blastophagapsenes* (fig wasp).

4.1.2. Insect as a soil composer: *Coptotermesformosanus* (termite).

4.1.3. Insect as a predator: *Vespula vulgaris* (wasps), *Photinus spp.* (fireflies), *Pselliopusberberi* (assassin bug), *Formica spp.* (ants).

4.1.4. Insect as parasites: *Camponotus* butterfly and *Ichneumon spp.*

#### 4.2 Conservation of insect

- 4.2.1. Strategies for insect conservation
- 4.2.2. Honey bees: Colony Collapse Disorder (CCD)
- 4.2.3. Butterfly gardens
- 4.2.4. Endangered insect species in India (any 4)

### Unit 5: Apiculture

#### Objective:

- *To introduce the domestic species of honey bees.*
- *To study the modern methods of apiculture/beekeeping.*
- *To familiarize the learners to the economic aspects of apiculture.*

#### Desired outcome:

- *Learner would adopt modern rearing techniques of honey bees.*
- *Learner would realize the economic scope of apiculture.*
- *Learner would be able to correlate growth of crop production with the pollinator role of honey bee.*

- 5.1. Different species of bees: *Apis dorsata* (Giant honey bee), *Apis mellifera* (Western honey bee), *Apis florea* (Dwarf honey bee), *Apis indica*. (Indian honey bee) and *Trigonasp* (Indian stingless bee).
- 5.2. The Apiculture business: Structure of artificial bee hive, method of cultivation, tools used and management of apiary.
- 5.3. Natural enemies of honey bees.
- 5.4. Products: honey, wax, royal jelly, venom, propolis and economic importance of bee keeping.
- 5.5 Co-operative movement and socio-economic approach for apiculture.

### Unit 6: Sericulture

#### Objective:

- *To study the various types of silk worms.*
- *To expose the students to laboratory techniques of rearing of silkworms.*
- *To understand the commercial uses of silk of biological origin.*

#### Desired outcome:

- *Learner would be introduced to different types of silkworms.*
- *Learner would understand the merit of modern methods of sericulture.*
- *Learner would understand products of sericulture.*

- 6.1. Different types of silk moth. Life cycle of *Bombyx mori* (Mulberry silk moth).
- 6.2. The Sericulture business: cultivation of mulberry, laboratory setup, rearing of worms (Procuring eggs, incubation, hatching and maintenance of larvae), overall management, diseases of silk worms.
- 6.3. Process of obtaining silk from cocoons and variations with reference to other silk moths.
- 6.4. Uses of silk and economics of sericulture.

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6.5 Co-operative movement and socio-economic approach for sericulture.

**Unit 7: Lac culture**

**Objective:**

- *To equip learners with the knowledge of methodology of Lac culture.*
- *To enable the learner to understand the processing and uses of Lac.*

**Desired outcome:**

- *Learner would acquire basic knowledge of methodology of Lac culture*
- *Learner would understand the processing techniques of stick Lac to powder Lac.*
- *Learner would understand the commercial uses of Lac.*

- 7.1. The *Kerria laca* (lac insect); life cycle, hosts, culture techniques.
- 7.2. Natural enemies of lac insects.
- 7.3. Processing of raw lac to fine lac and uses of lac.
- 7.4. Value addition through lac producers.
- 7.5. Co-operative movement and socio-economic approach for lac culture.

**Unit 8: Case study & Simulation**

**Objective:**

- *To help learner to understand success stories of entrepreneurs.*
- *To inculcate learners to adapt innovative ideas and through provoking creative concepts of entomology-entrepreneur.*

**Desired outcome:**

- *Learner would be inspired to become entomology-entrepreneur and consult others to become the same.*
- *Learner would become capable to form consultation firm in the field of entomology.*

(Colleges/institutes have to select the topics as per their local needs and available resources related to Entomology.)

(Any eight from suggested below, or more developed by teacher)

8.1 Patanjali honey

8.2 Mad honey

8.3 Halal lipsticks

8.4 Odomos

8.5 Kapse and Soni Paithani Saree

8.6 Hotlix (Ant candy, Larvets)

8.7 Jaipurwala.com

8.8 Wasp eggs for sale by BASARASS Biocon India Pvt. Ltd. Chennai (*Trichogramma sp.*)

**Semester V**  
**Practicals**  
**Course Code USACEENT5P1**

**(Photographs, Pictures or models should be used to conduct practicals)2 Credits**

1. Study of head sclerites, thoracic segments, and abdominal segments of cockroach.
2. Study of types of antennae. Filiform, Moniliform, Aristate, Capitate, Clavate, Clubbed, Plumose, Pilose, Pectinate, Bipectinate, Setaceous and Geniculate, Lamellate, Serrate.
3. Study of halter and wing of house fly.
4. Study of wing types: membranous, hemitegmina, tegmina, hemielytra, elytra with photos or permanent slides.
5. Study of types of legs- Typical, Cursorial, Fossorial, Saltatory, Natatorial and Scansorial
6. Study of abdominal appendages- Styles, cerci of cockroach, study of abdominal gills).
7. Study of cornea of *Periplanetaamericana*(Cockroach) or *Muscadomestica* (Housefly).
8. Study of mouth parts of Cockroach.
9. Study of Malpighian tubules of Cockroach.
10. Study of haemocytes of Cockroach.
11. Observation of permanent slides or photographs of legs of honey bee.
12. Study of Cockroach: Digestive system and nervous system..
13. Study of the following:
  - Any one sound producing organ.
  - Identification, classification and description: silverfish, cricket, termite, giant water bug, any one type of butterfly or moth, flesh-fly, potter wasp, long horn beetle or water beetle, dragonfly, damselfly. – use photos
  - Types of larvae and pupae, Types of metamorphosis.
  - Life cycle of lac insect, honey bee, silk moth.
  - Products – Lac, bee wax, silk.
  - Equipments used in apiculture, sericulture, lac culture.
  - Examples of mimicry, camouflage and concealment e.g. Plain tiger and Danaid egg fly. Stick insect, leaf insect.
14. Photographic documentation of entomology related issues. Submission of soft & hard copy of 5 original photographs taken by the learner (Exif details required)
15. Assignment (may be submitted in a group not exceeding three students).

**Please refer Annexure I for suggested topics for assignments.**

**\*Note- The practicals may be conducted by using preserved specimens/ permanent slides authorised by the wild life and such other regulating bodies though it is strongly recommended that the same should be taught by using**

**photographs/audio-visual aids/simulations/ models etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in above.**

**N.B:**

- I) It is pertinent to note that we have to adhere strictly to the directions as given in the UGC Circular F14-4/2006 (CPP-II).
- II) Apart from the institutional Animal Ethics Committee (IAEC) and any other Committee appointed by a Competent Authority/Body from time to time, every college should constitute the following Committees:
  - 1) A Committee for the Purpose of Care and Supervision of Experimental Animals (CPCSEA) and
  - 2) A Dissection Monitoring Committee (DMC) to ensure that no dissections or mountings are done, using animals.

**Composition of DMC shall be as follows:**

- i) Head of the Concerned Department (Convener/Chairperson)
- ii) Two Senior Faculty Members of the concerned Department
- iii) One Faculty of related department from the same College
- iv) One or two members of related department from neighbouring colleges.

<p><b>USE OF ANIMALS FOR ANY EXPERIMENT/DISSECTION/MOUNTING IS BANNED. SIMULATIONS, AUTHORISED PERMANENT SPECIMENS/SLIDES, CHARTS, MODELS AND OTHER INNOVATIVE METHODS ARE ENCOURAGED.</b></p>
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**Semester VI: Theory**  
**Commercial Entomology**

Course code: USACEENT601

(Any 4 units to be opted)

Lectures 60  
Credits 02

**Unit 1: Organic and Biological Pest Control in Agriculture**

**Objective:**

- *To introduce concept of advantages and limitations of IPM.*
- *To enable the learners to understand the advanced methods of biological control of insect population.*
- *To understand pest population and about natural insecticides.*

**Desired outcome:**

- *Learner would be introduced to the merits and demerits of IPM.*
- *Learner would be able to understand different methods of biological control of insect pest.*
- *They would also be introduced the insecticides of plant origin.*

1.1. Integrated Pest Management (IPM): Definition, need and planning of IPM with suitable examples. Advantages and limitations of IPM.

1.2. Biological pest control :

- a) Predators
- b) Parasites
- c) Pathogens (Bacteria, viruses, fungi)
- d) Nematodes

1.3. Use of Hormones and Pheromones.

1.4. Sterile male technique.

1.5. Natural organics – oils, insecticides of plant origin (Pyrethrins, Nicotine, Azadiractin), insecticides of animal origin (Chitin, Chitosan)

**Unit 2: Chemical pest control in agriculture**

**Objective:**

- *To study the various types of insecticides.*
- *To acquire the knowledge about the modes of operation of duster and sprayers*
- *To correlate use of natural insecticides with synthetic insecticides.*

**Desired outcome:**

- *Learner would understand the classification of insecticides on the basis of mode of action of insecticides.*
- *Learner would understand specific use of sprayer and duster.*
- *Lerner would understand the feasibility of natural insecticides over synthetic insecticides.*

- 2.1. Broad classification of insecticides.
- 2.2. Types, characteristics, mode of action, application and precautions for the following inorganic insecticides:
  - Arsenicals, lime -sulphur, mercury compounds, fluorine compounds
  - Fumigants- para dichlorobenzene, methyl bromide, hydrogen cyanide).
- 2.3. Types, characteristics, mode of action, application and precaution for the following synthetic organic insecticides:
  - Chlorinated hydrocarbons (BHC, methoxychloro),
  - Organophosphate (malathion, parathion, dicrotophos, chlorpyriphos), carbamates (carbaryl, propoxur) and pyrethroids (allethrin, cypermethrin).
- 2.4. Insecticide formulations- dust, granules, emulsifiable concentrates, wettable powders, aerosols.
- 2.5. Techniques of fumigation and equipments used for insecticide applications: dusters, sprayers (Hand operated, Back snap, Foot operated), precautions and maintenance of the equipments.
- 2.6. Advantages and disadvantages of insecticides.

### Unit 3: Urban and Domestic Pest Control

#### Objective:

- *To introduce types of insect pests.*
- *To study the nature of damage and preventive measures of urban and domestic pest.*
- *To create awareness about serious household pests and pest on pet animal.*

#### Desired outcome:

- *Learner would be made aware about economic loss caused by insect pest.*
- *Learner would understand type of urban and domestic insect pest and their preventive measures.*

- 3.1. Agricultural pests: Grasshoppers, bugs, caterpillars, scale insects, leaf hoppers, bean beetles.
- 3.2. Stored grain pests: *Sitophilusoryzae* (Rice-weevil), *Tenebrio* (meal-worm), *Trogoderma* (Khapra beetle), *Triboliumconfusum* (Flour beetle).
- 3.3. Pests on animals: Bird louse, warble fly, screw worms, horse botfly
- 3.4 Control of house-hold pests:
  - a) *Periplanetaamericana* (cockroach), *Muscadomestica*(housefly), *Glossina* (Tsetse fly), *Phlebotomus* (sand fly), *Formic idea* (ant), *Culicidae*(mosquito), *Pediculushumanus*(head louse) , *Xenopsylla* (oriental rat flea)
  - b) *Lepisma* (Silver fish), *Psocids* (book lice), *Tineolabisselliella* (cloth moth) ,carpet damaging insects.
  - c) Powder post beetle, *Coptotermesformosanus* (termite).

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#### Unit 4: Neo-avenues

##### Objective:

- *To introduce different values of insects in modern lifestyle and mankind.*
- *To understand the role of certain insects in forensic science.*

##### Desired outcome:

- *Learner would take more interest in the study of insects due to their versatile nature.*
- *Learner would understand the use of some insects in the investigation of crime (Forensic science).*

#### 4.1. Neo-avenues

- 4.1.1 Insect as food (Entomophagy)
- 4.1.2 Insect as medicine (Entomotherapy)
- 4.1.3 Insect as weapons (Entomological warfare)
- 4.1.4 Insect as pets
- 4.1.5 Insects of forensic importance-collection and analysis of entomological evidence  
Brief mention of common insects of forensic importance –
  - a. Order Diptera- Calliphoridae, Sarcophagidae and Muscidae
  - b. Order Coleoptera -Staphylinidae, Histeridae, Silphidae, Dermestidae and Cleridae.
  - c. Collection of entomological evidence during a death investigation.
  - d. Temperature and climatic records, collection, preservation and handling of insects/maggots from the crime scene.
  - e. Analysis of entomological evidence and estimating PMI (Post Mortem Index) using Maggot age and Insect succession.

#### 4.3. Insect biotechnology

- 4.3.1. General introduction to insect biotechnology.
- 4.3.2. Use of insects in tissue culture and genetic studies as model animals.
- 4.3.3. Importance of insects in medicine and cosmetics with respect to biotechnology.

#### Unit 5: Government Schemes

##### Objective:

- *To help learner to tap resources from government schemes to start entomology- based bio-industry.*
- *To introduce learner to funding agencies like NABARD, KVIC, DIC etc.*
- *To help learner to study and understand feasibility report.*

##### Desired outcome:

- *Learner would get knowledge about schemes to avail resources.*
- *Learner would be well introduced about various funding agencies and guidelines to apply for subsidized loan.*

- *Learner would understand the viability of the project on the basis of feasibility report.*

5.1. Government schemes

5.1.1. Schemes for sericulture.

5.1.2. Schemes for bee-keeping.

5.1.3. Schemes for lac-culture.

5.1.4. NABARD (National Bank for Agriculture and Rural Development), KVIC (Khadi and Village Industries Commission), DIC (District Industries Centre), MUDRA, START-UP INDIA, STAND-UP INDIA.

5.2 Entrepreneurship opportunities in post-processing with respect to products of sericulture, apiculture and Lac culture.

5.3. Preparation of Feasibility report:

- Area of production
- Marketing strategies
- Prime cost
- Capital raising
- Evaluation of project
- Profitability of project
- Actual production
- Actual sale
- Audit of variances

**Unit 6: Finance**

**Objective:**

- *To study the financial aspects and bio-industry like apiculture, sericulture, and Lac-culture.*
- *To introduce the various concepts of general account like costing, budget, depreciation to maintain the business.*

**Desired outcome:**

- *Learner would be able to understand financial entomology based projects.*
- *Learner would familiarize with basic concepts in accountancy.*

6.1. Costing

6.1.1. Basic concepts: types of cost (historical, standard and managerial).

6.1.2. Budget: budgetary control-types of costing (process, batch, job, service).

6.1.3. Variances: Material, labour and overheads.

6.2. Basic accountancy:

6.2.1. Basic terms, Golden rules in accounts, types of accounts (Indian), journal entry, ledger posting, subsidiary book, single column cash book, double column cash book.

6.2.2. Depreciation: fixed installment, reducing balance method.

6.2.3. Rectification of error.

6.2.4. Final account

**Unit 7: Sales and Marketing**

**Objective:**

- *To understand the fundamental concepts of marketing.*
- *To help learners to find profitability in the entomology based industries.*
- *To understand distribution and storage of products.*
- *To learn to advertise and to do branding of the products.*

**Desired outcome:**

- *Learner would understand and apply marketing strategies.*
- *Learner would learn to manage and distribute products unto the satisfaction of market.*
- *Learner would also focus attention on branding of product.*

7.1. Fundamentals of marketing.

7.2. Concept of 4 P's (Product, Price, Promotion and Place)

7.3. Distribution and logistics.

7.4. Advertising.

7.5. Branding.

**Unit 8: Open Unit**

Open unit is one of the eight units that may or may not be opted by the college. Teachers in consultation with the students shall define syllabus under this unit every year, and shall seek endorsement of the Head and the Principal.

Colleges/Institutes have to select the topics as per their needs and available resources. It is pertinent to note that the open unit shall be operational and available in the syllabus only until it comes under the scope of internal assessment.

**Objective:**

- *To motivate learner for self-employment.*
- *To avail of vast literature on apiculture, sericulture and lac culture and IPM.*
- *To build confidence among young learners about entrepreneurship.*
- *To inculcate research aptitude among science graduates.*
- *To encourage learner to work in association of partners to reduce economic burden in the initial stage.*
- *To boost the learners' interest to renew natural resources.*

## SEMESTER VI Practicals

### Course Code USACEENT6P1

1. Observation of permanent slides of mouth parts of mosquito.
2. Insecticide formulations. (Dust, Granules, Emulsifiable concentrates, sprays, wettable
3. Powders).
4. Study of damage caused by and control of - Grasshopper, plant bug, caterpillar, scale insect, , *Eurymeloidesbicincta*(Leaf hopper), *Sitophilusoryzae*(Rice-weevil), *Acanthoscelidesobtectus*(Bean weevils), *Tenebrio* (meal-worm), Flea, Bird louse, Mosquito (*Anopheles*, *Culex*, *Aedes*), *Glossina* (Tsetse fly), *Phlebotomus* (sand fly) , *Hypoderma spp.*(warble fly), *Cochliomyia spp.*(screw worm fly).
5. Vertebrates important for biological control against insect pests - Guppy fish, Frog, Gecko, Wood pecker, Bat, Scaly anteater and Bear.
6. Any two insect types breeding on the flesh of dead bodies (one Dipteran, one Coleopteran).
7. Demonstration of use of different equipments such as drills, sprayers, dusters for household insect control (insecticides).
8. Qualitative estimation of proteins and sugars from different varieties of honey.
9. Visit to any industry and submission of report.
10. Project and submission of report (Project report may be submitted in a group not exceeding three students).

**Please refer to Annexure- II for suggested Field Visits and Annexure III for suggested topics for projects for Course code USACEENT6P1.**

**\*Note- The practicals may be conducted by using preserved specimens/ permanent slides authorised by the wild life and such other regulating bodies though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/simulations/ models etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in above.**

### **N.B:**

- I) It is pertinent to note that we have to adhere strictly to the directions as given in the UGC Circular F14-4/2006 (CPP-II).
- II) Apart from the institutional Animal Ethics Committee (IAEC) and any other Committee appointed by a Competent Authority/Body from time to time, every college should constitute the following Committees:
  - 1) A Committee for the Purpose of Care and Supervision of Experimental Animals (CPCSEA) and

- 2) A Dissection Monitoring Committee (DMC) to ensure that no dissections or mountings are done, using animals.

**Composition of DMC shall be as follows:**

- i) Head of the Concerned Department (Convener/Chairperson)
- ii) Two Senior Faculty Members of the concerned Department
- iii) One Faculty of related department from the same College
- iv) One or two members of related department from neighbouring colleges.

**USE OF ANIMALS FOR ANY EXPERIMENT/DISSECTION/MOUNTING IS BANNED. SIMULATIONS, AUTHORISED PERMANENT SPECIMENS/SLIDES, CHARTS, MODELS AND OTHER INNOVATIVE METHODS ARE ENCOURAGED.**



**References and Additional Reading**  
**USACEENT501 &USACEENT601**

1. A General textbook of entomology -- A D Imms. Asia Publication.
2. Agricultural insect pests and their control. V.B. Awasthi. Scientific Publication.
3. A manual of practical entomology. – M MTrigunayat. Scientific Publication.
4. Applied Entomology – Alaka Prakash and Fennemore. New Age Publishers.
5. Applied Entomology – Awasthi. Scientific Publication.
6. A Text book of insect morphology, physiology and endocrinology – Tembhare D. B.– Chand Publication.
7. Cost Accounting by Manan Publication F.Y.BAF.
8. Destructive and Useful Insects.- Metcalf and Flint. McGraw Hill Publication.
9. Economic Zoology- Shukla, Upaddhaya and Srivastava. S. Chand Publication.
10. Edible insects: Future prospects for food and feed security- Arnald van Huis, Joost Van Itterbeeck, Harmke Klunder, Esther Mertens, Afton Halloran, Giulia Muir and Paul Vantomme, FAO of the United Nations, Rome, 2013. (Available online).
11. E. Paul Cherniack, M.D. (2010): Bugs as Drugs, Part 1: Insects. The “New” Alternative Medicine for the 21<sup>st</sup> Century. *Alternative Medicine review*, 15 (2), 124-135.
12. Entomology and Pest Management –Larry P. Pedigo. Pearson Education.
13. Forensic Entomology-The utility of Arthropods in legal investigations. –Jason H. Byrd and James L. Castner. CRC Press.
14. General and applied Entomology – David and Ananthkrishnan. Tata McGraw Hill
15. Insect endocrinology and physiology – Tembhare D B – S Chand publication.
16. Insect Jewelry by Roger D. Akre., Laurel D. Hansen, and Richards S. Zack: in Summer (1991). (Online available as research article).
17. Insect Year Book of Agriculture- American Agriculture Department Publication.
18. Irwin, M. E. and Kampmeier, G. E. (2002): Commercial products, from Insect. In V. H. Resh and R. Carde (eds.) *Encyclopedia of insects*. Academic press, San Diego.
19. Jeffrey A. Lockwood - Entomological warfare: History of the use of insects as weapons of Wars: in *Bulletin of the ESA in Summer* (1987). (Online available as research article).
20. Laboratory manual of entomology – Alaka Prakash. New Age Publishers.
21. Photographic Atlas of Entomology and guide to insect identification.-Castner. Seline press Florida. Marketed by Scientific Publication.
22. Principles of insect morphology- Snodgrass R E – Tata McGraw Hill.
23. Principles of insect physiology – Wigglesworth. – ELBS Publication.
24. S. Turner (2008): Termites: Friends or Foe. AGRICOLA.
25. Text book of Entomology—Ross – John Wiley publ.
26. The Insects - Structure and Function - 4th Edition, R. F. Chapman (ed.). Cambridge University Press 1998.

27. Theodore A. Evans., Tracy Z. Dawes, Philip R. Ward and Nathan Lo (2011):  
Ants, and termite increases crop yield in dry climate. Nature communication.  
262. doi:10.1038/ncomms1257

**Books in Marathi:**

1. *Keetknirikshakamchasobati*: Purushottam Joshi, Continental publication, Pune.
2. *Gruhaupayagikeetak* :Purushottam Joshi, Continental publication, Pune.
3. *KeetakParichaywaSangraha*: Purushottam Joshi, Continental publication, Pune.
4. *PikanvareelKeed – Keetak*: Purushottam Joshi, Continental publication, Pune.
5. *Madhmashya – JeevanaaniPalan*: R. V. Ranade, Continental publication, Pune.

**SCHEME OF EXAMINATION (THEORY & PRACTICAL)**

(a) Internal assessment of twenty five (25) marks per course per semester should be conducted according to the guidelines given by University of Mumbai vide circular number UG/04 of 2014 Dated 5th June 2014 to be implemented from academic year 2014-15.

(b) External assessment of seventy five (75) marks per course per semester should be conducted as per the following skeleton question paper pattern.

(c) One practical examination of one hundred (100) marks per course each should be conducted at the end of every semester.

**Modality of Assessment:  
Theory Examination Pattern:**

**A) Internal Assessment - 25%  
marks**

**25**

**Theory 25 marks**

Sr. No.	Evaluation type	Marks
1.	Class test to be conducted as per following pattern	20
	a. Match the column/Fill in the blanks/Multiple Choice Questions (1/2 mark each)	05
	b. Answer in 1 or 2 lines (Concept based questions) (1 mark each)	05
	c. Answer in brief (Attempt any 2 out of the 3) (5 marks each)	10
2.	Overall conduct as a responsible student, manners, attentive and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

**B) External examination - 75 %  
Semester End Theory Assessment - 75%  
marks**

**75**

1) Duration - The examination shall be of two and half hours duration.

2) Theory question paper pattern:

- a. Q1 shall comprise of 16 short notes (14 if case studies/open unit is not opted) representing all the units in the syllabus equally, of which students are expected to solve any five.
- b. Q2 to Q9 (Q8 if case study/open unit is not opted) will be based on unit I to unit VIII of the syllabus respectively.
- c. Q2 to Q9 (Q8 if case studies/ open unit is not opted) shall have the following pattern.

**A) 15 marks  
OR**

**AC - 11<sup>th</sup> May, 2017**  
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- B) i) 7 marks**  
**ii) 8 marks**

**Practical skeleton Paper Course code: USACEENT5P1**

Duration: 4hrs

Total Marks: 100

- Q.1. Identification :** **20**  
Identify spots 'a' to 'e' as per instructions.  
a) Identify and describe the insect part; wings/ legs/ head sclerites/ antennae.  
b) Identification and describe cornea/mouth parts/ malphigian tubules / abdominal appendages of cockroach/ haemocytes  
c) Identify classify and describe the given insect /sound producing organ of insect  
d) Identify and describe types of larva / pupa/life cycle of insects.  
e) Identify and describe insect product/ equipment/eg. of mimicry/ camouflage/ concealment
- Q 2. Major experiment** **25**  
Draw neat and labeled diagram of -----system.  
Complete the given system by drawing the missing part and describe the function of all labeled parts.  
**OR**  
Rearrange the parts of the given system and explain the functions of different parts.
- Q3. Minor experiment** **15**  
Make diagrammatic representation of following parts of -----  
-and describe the region where it is situated in the animal along with its function.
- Q4.** a) Submission of 5 relevant photographs. **10**  
b) Assignment and viva based on it. **20**
- Q5.** Certified journal **10**

**Practical skeleton Paper Course code: USACEENT6P1**

**Duration: 4 hrs Total Marks: 100**

- Q. 1. Identification 20**  
Identify spots 'a' to 'e' as per instructions.
- a) Identify and describe legs of honey bees/ mouth parts of mosquito.
  - b) Identify and describe mosquito larvae/ rice weevil/ flour beetle
  - c) Identify and describe the given insecticide formulation/
  - d) Identify and describe insecticide dispersing equipment/ house hold pest control device.
  - e) Identify and describe the vertebrate important for biological control/ insect type on dead bodies
- Q.2 Major experiment 25**  
a) Detection and estimation of proteins from different varieties of honey.  
**OR**  
a) Detection and estimation of sugar from different varieties of honey
- Q.3 Minor experiment 15**  
Describe damage caused by the following insects (Any three)  
**OR**  
Describe the control measures for the following insects (Any three)
- Q.4. Project report and viva based on it. 20**
- Q.5. Field report 10**
- Q.6. Certified journal 10**

## ANNEXURES

### Annexure-I: Suggested topics for assignment USACEENT5P1

(Teachers are expected to develop additional innovative topics, varying every year, to be assigned to the students)

1. Visit Govt. office to find subsidies for different entomology related industries.
2. Study the wholesale and retail marketing of the insecticide.
3. Study the production of insecticides in the industry.
4. Study marketing of insecticides by interacting with the salesman/others concerned.
5. Study any one unit of sericulture /culture/apiculture.
6. Survey recent research trends in biological control of insect pests.
  - a. Study the institutes actively guiding on Biological control.
  - b. Study the insecticide /formulations available in the market and decide their demand in the market.
7. Obtain from internet/books/journals, taxonomic keys for different insect orders.
  - a. Species of Bees (solitary & social) and their role as pollinators.
  - b. Diseases and natural enemies of bees.
  - c. Bee products and their uses.
  - d. Types of silk moths (wild & semi domesticated) and their contribution to the National silk production.
8. Diseases and enemies of silk moths.
9. Comparison of the current status of lac industry in Bihar and Maharashtra.
10. Diseases of lac insects and uses of lac in industry.
11. Role of MahilaAarthikVikasMahamandal in insect related small scale enterprise (Sericulture, Lac culture).
12. Role of Khadi and Village Industry in encouraging insect related enterprises (Apiculture, Bio-control).
13. Comparative study of social life of bees, ants and termites.
14. Insecticide formulations and applications.
15. Maintenance and working of equipments used in insecticide application.
16. Advantages of IPM quoting successful case studies.
17. Visit KVIC website and find out various subsidies offered to Apiculturist.
18. Visit KVIC website and find out marketing support to Sericulturist and Lacculturist.
19. On the basis of colour of eyes or structure of wings, take some photographs of Common Fruit Fly either by keeping banana or any fruit in the window of your house or lab or obtain information from internet. Find some of the mutants of fruit flies. Comment on any two mutants of them.
20. Visit any one website or home page of insecticide or pesticide manufacturing Co. Note their products and try to categorize them as an insecticide on the basis of mode of action. Also try to search their annual turnover. Explain any two pesticides with examples. (Contact poison, Fumigants, Stomach poison etc.)
21. Visit food and drug administrative office and find out the norms of standard marketed honey.

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**Item No. 4.232**

22. Visit DIC office in your district and find out the various loan schemes based on Economic Entomology for unemployed science graduates.
23. Give the best measures to control mosquito population without using chemicals other than natural insecticides. Also find economically useful methods to control mosquitoes.
24. Comment on the Common Housefly as a biological vectors. Give its preventive and natural control methods.
25. Find from internet, insects pheromones or hormones strategic use in the control of horticultural insect pests.

**All topics mentioned above are suggestive, more creative and innovative topics are expected from the students, under the able guidance of the concerned teacher, to suit the expertise human resources, infrastructure and local needs as also the interest of the students.**

**The assignment may be submitted in a group of not more than three students.**



**Annexure II: Suggested field Visits USACEENT5P1**

- There shall be various short and long excursions/study tours/field visits/industrial visits in every semester, at least one of which shall be financially affordable to every student in the class; and that assignment and marks of field trip shall be solely based upon such where no student was restrained for financial limitations.
  - Field visits are to be organized to facilitate students to have first-hand experience & exposure to technology/production/functioning of organization/units or witness a relevant activity.
  - Each student must take at least 01 (one) such visit to the units/treatment plants/aquatic or terrestrial habitat organized by the college.
  - The list is suggestive and not exhaustive.
1. Visit to an Apiculture unit.
  2. Visit to a Sericulture unit.
  3. Visit to a Lac culture unit.
  4. Observe insects from the given area to study diversity.
  5. Observe and study aquatic insects.

**Annexure III: Suggested Topics for Projects USACEENT6P1**

(Teachers are expected to develop additional innovative topics, varying every year, to be assigned to the students)

- 1) Prepare a feasibility report on Apiculture unit – small/medium/large scale.
- 2) Prepare a feasibility report on Sericulture unit – small/medium/large scale.
- 3) Prepare a feasibility report on Lac culture unit – small/medium/large scale.
- 4) Prepare a feasibility report for setting up a pest control business.
- 5) Study of behavior of insect pests.
- 6) To compare the toxicity of insecticide using different insect models or stages of insects.
- 7) To prepare different types of baits and test their efficacy.
- 8) To try different plant extracts/ chemicals for their synergistic activity.
- 9) Monitor the life cycle of insects of forensic importance, throughout the year to record seasonal differences.
- 10) Find agricultural and horticultural pest one each and give the nature of damage caused. Guide the farmers to control them naturally.

**The project may be submitted in a group not exceeding three students.**

**Annexure IV: Learners' space**

When education system today has identified special needs of slow learners we are still silent about needs of high IQ students. Teachers are therefore recommended to identify and encourage such students to undertake research with a view to publish paper/s in peer reviewed International Indexed Journals with high impact factor thus providing 'learners' space'

1. Carry out a literature review of heat shock proteins in different larval stages of insects for pest management.
2. Find out the irradiation techniques used for pest control
3. Find out the norms for export of irradiated food products.
4. Use of biotechnology in pest/control management.

**Annexure V: Play and Ponder**

As learner's space is for high IQ students, play and ponder could be a general activity creating interest in the subject and could also be a part of pedagogy wherein it may be considered as innovative teaching methodology. Needless to say that 'play and ponder' again is not mandatory and is an additional if deserved by the students.

1. Maintain a bee hive.
2. Maintain a stingless bee colony.
3. Behavior studies.
4. Grow larvae/nymphs of insects to study life cycle.
5. Maintain silk moth larvae.
6. Study Lac culture.
7. Grow in laboratory, flies/beetles breeding on flesh and note the details of their behavior.
8. Does the scent or color of a flower attract an insect?
9. Temperature prediction by recording cricket chirps per minute.
10. Effect of sex pheromones on insects.
11. Inter species communication – talking to fireflies.
12. Maintain an ant hill to understand community living.

## Model Question Paper USACEENT501

Duration 2.5 hrs

Maximum Marks 75

**N.B:** 1.Question 1 is compulsory.

2. Attempt any FOUR questions from Q.2 to Q.9.

3. Draw neat and labeled diagrams wherever necessary.

**Q1** Write short notes on any **five** of the following(Mixed questions from all units) **15**

- a) Odonata,
- b) Thysanura,
- c) Types of Pupae
- d) Types of larvae
- e) Morphology of Ants
- f) Anatomy of Aphid
- g) Role of Assassin Bugs
- h) Role of Fireflies
- i) Economic importance of Bee wax
- j) Bee venom
- k) Diseases of silk worm
- l) Uses of silk
- m) Species of Lac insects
- n) Host of Lac insect
- o) \_\_\_\_\_ (From case study if opted)
- p) \_\_\_\_\_ (From case study if opted)

**Q.2 Question based on Unit 1** **15**  
Describe with suitable example characteristics of order dipteral and order coleopteran, add a note on insect classification.

**OR**

- a) Classify and describe order Hemiptera. **7**
- b) Classify and describe with suitable example order Orthoptera **8**

**Q.3 Question based on Unit 2** **15**  
Explain morphology of typical insect.

**OR**

- a) Describe digestive system of insect. **7**
- b) What is metamorphosis? Explain metamorphosis in insects. **8**

**Q.4 Question based on Unit 3** **15**  
Explain lifecycle of following insects and their effect on agriculture.  
1) Grass hopper, 2) Aphid

**OR**

- a) Describe lifecycle of mosquito. 7  
b) Describe life cycle of tsetse fly and bedbug. 8
- Q.5 Question based on Unit 4 15**  
Explain the role of insect in agriculture and add a note on 'Termites as soil composer'  
**OR**  
a) Enumerate the reasons for CCD of honeycomb. 7  
b) What are the different strategies for insect conservation? Add a note on butterfly garden. 8
- Q6 Question based on Unit 5 15**  
Describe economic importance of honeybee. Add a note on cooperative and socio-economic aspect of apiculture.  
**OR**  
a) Describe structure of artificial hive. Add a note on various tools used in apiculture. 8  
b) Enlist and describe species of honey bee found in India. 7
- Q.7 Question based on Unit 6 15**  
What is Sericulture? Explain how different types of silk is obtained.  
**OR**  
a) Explain in detail the lifecycle of mulberry silk moth. 8  
b) Explain the processing of silk cocoons. 7
- Q.8 Question based on Unit 7 15**  
Explain the management and financial avenues for setting up of Lac culture business.  
**OR**  
a) Explain culture techniques of lac and add a note on it's natural enemies 8  
b) Explain processing of lac. 7
- Q.9 Question based on Unit 8 15**  
Question based on case study/ simulation (if opted)

### MODEL CASE STUDY

#### 1. PAITHANI

Paithani is a sari made of silk and zari. It is named after the Paithan town in Aurangabad, Maharashtra state where they are woven by hand. The art of weaving Paithani thrived in 200 B.C., during satvahana era and promptly became well-known. The special love of Peshwas for Paithani in 18th century has endowed a name to Paithani as "Queen Of Sarees". By tradition,

Paithanis used a coloured, cotton muslin field with zari patterning. However, in the 19th century, silk fields were also woven. They became so widespread during this era that it became a tradition for every Maharashtrian woman to have at least one Paithani sari.

It is made from very fine silk and it is also considered as one of the richest saris in India.

The Government of Maharashtra & a few Non-Government Organizations (NGO's) took the colossal task of "Revival of Paithani". The initial step to revive this lost art was to boost the morale of the weavers and then set up centers for training & weaving. Their cooperative determination paid off & the last 3 decades saw the growth in demand of Paithani sarees from all over the world. Today, Yeola itself has more than 2000 skilled weavers.

Two entrepreneurs took the opportunity to build their fortune in business of making and selling paithani, by which they made a world-renowned brand namely Soni Paithani and Kapse Paithani.

**Ramdayal Hanumandas Soni**, also known as Soni Paithani - a name that has grown for over five generations in the manufacturing of Paithani sarees. Soni Paithani came into life in the year 1860 and since then many of the weaver's families are linked with them. They have passed their knowledge & unique weaving techniques to new generation. A Paithani requires processes like cleaning and dyeing of silk, which demands for the input of the whole family.

Kapse Paithani established in year 2000 at KK Handloom. They are the foremost suppliers of Maharashtrian Sarees like Yeola Paithani, Bocket Paithani, Special Padar Paithani, Banarasi Silk Paithani.

Saree is the most elegant Indian wear and the oldest form of women's wearing, to keep up with the change of time Kapse Paithani merged the traditional artwork with modern designs to lure the international young market.

In the early days, Exquisite Silk from Paithani was exported to many countries in exchange for gold and precious stones. In the past days, the Jari used in making Paithani was drawn from Pure Gold. But today Silver is replaced for Gold and in some cases Copper substitutes Silver making the Paithani affordable to many People. It costs nowadays between Rs 7,000/- to Rs 3,50,000/- approximately, depending upon the design. Silk-Mark is an assurance that every Silk Paithani is made from finest Pure Natural Silk. Each product is tested and validated for quality, sustainability and accompany Silk-Mark.

The Paithani Saree and Fabrics known for their elaborate designs are protected under Geographical Indication Act 1999 of India. At present it is unorganized sector.

The skills gap for Silk weavers are:

- Need to transform from traditional looms to automated looms
- Limited understanding of the 52 steps in silk weaving

- Training is required on usage of computers in designing
- Ability to create diversified products – new varieties, replacing jute or cotton products with silk
- Export market awareness
- Dying techniques
- Processing techniques

The Paithani Cluster at Yeola, a Rs 20-crore project, is spread over 4,800 sq m where around 3,000 local artisans put their products on display under one roof and tourism centre on its premises to educate people. If the silk produced in Maharashtra would be used in Yeola for Paithani saris, then it would be much cost effective than to depend on Bengaluru for silk. There are 3,500 looms in Yeola and the material, particularly silk, is brought from Bengaluru. In one month, 6,000 Paithani saris are made in Yeola. Around one kg of silk is needed to weave one sari.

Markets of Paithani saree need to be created across the nation to popularize the art. To sustain the craft and the craftsmen, diversification of Paithani textile into several products such as waistcoats, pouches, wall hangings and even women's salwar suits is required to increase their market size.

1. What are the skills silk weavers can be trained to create more effective sales of Paithani? Justify your answer with explanation.
2. What entrepreneur opportunity you can see in the above case? Illustrate a detail planning and feasibility statement.
3. Enlist the uses of Paithani fabric and emphasis on the marketing strategy for it.

OR

## 2. ODOMOS

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The household insecticide market in India is sized around Rs. 1600 crore. Insecticide market of mosquito coil is worth Rs 900 crore, while mosquito repellent cream is worth Rs 50 crore. Odomos is a 40 year old brand which has a generic status in the mosquito repellent cream market in India. The brand which was initially from Balsara came into Dabur's hold after the acquisition of Balsara Hygiene Products in 2005. Odomos possibly initiated cream-based insect repellent as a branded offering. Odomos has a virtual monopoly in the cream market.

Dabur is the front-runner in the personal application mosquito repellent category under the Odomos brand with annual sales of around Rs 50 crore and growing at 8-10 per cent per annum. **Dabur Odomos** is a clinically tested and certified mosquito repellent offering most effective protection for as long as 12 hours from mosquitoes, the carriers of deadly diseases like Dengue, Chikungunya, Malaria, Filariasis and Encephalitis etc. Odomos is the only



mosquito repellent endorsed by the National Integrated Medical Association (NIMA). Since Odomos does not contain any chemicals which kill mosquitoes thus it is one of the safest mosquito repellants. Odomos Natural Cream with natural Citronella and Aloe Vera has the goodness of Almond Oil and Vitamin-E.

Contrary to popular notion, diseases like Dengue and Chikungunya are transmitted by daytime mosquitoes. Children, when they go out to play or during school, are at danger of being bitten by these mosquitoes. Even people in offices are at risk of being bitten by mosquitoes. Odomos is the only personal application product that offers protection from day-time mosquitoes. Mosquitoes detect you by the odours your body emits. Odomos, when applied on the skin, masks these odours and hence mosquitoes do not detect you.

Odomos displays the message of being "Skin Friendly" in their packs. Another bold step that the brand took was to target kids.

Odomos has product forms of Cream, Lotion and Oil. Odomos mosquito repellent oil targets rural areas because oil product form has more acceptance in that market. More over oil applies better on the skin and is more effective.

**Odomos** now have smaller packs of Rs 5 and Rs 10, which improves affordability and thus encourage more buys. In times where mosquitoes are now immune to coils and vaporizers, Odomos has proven to be a best option for a good night sleep and daytime assurance.

1. Do you think Odomos targeting kids was a risky move? Justify your answer with explanation. **7**
2. What entrepreneur opportunity you can see in the above case? Illustrate a detail planning and marketing strategy. **8**

## Model Question Paper USACEENT601

Duration 2.5 hrs

Maximum Marks 75

- N.B:** 1.Question 1 is compulsory.  
2. Attempt any four questions from Q.2 to Q.9.  
3. Draw neat and labeled diagrams wherever necessary.

- Q.1** Write short notes on any **five** of the following(Mixed questions from all units) **15**
- a) Advantages of IPM
  - b) Nematodes as biological pest control
  - c) Pyrethroids
  - d) Dust & granule insecticide formulations
  - e) Screw worm
  - f) Meal moth
  - g) Entomotherapy
  - h) Insect as weapons
  - i) Startup India
  - j) Qualities of an Entrepreneur
  - k) Historical cost
  - l) Golden rules in accounts
  - m) Concept of 4P's
  - n) Product advertising
  - o) ----- (from open unit, if opted)
  - p) -----(from open unit, if opted)
- Q.2 Question based on Unit 1** **15**  
Define IPM. Explain need & planning of IPM with a suitable example.  
**OR**
- a) Explain biological pest control. **7**
  - b) Describe the use of hormones & pheromones in pest control. Add a note on sterile male technique for pest control. **8**
- Q.3 Question based on Unit 2** **15**  
Explain classification of insecticides. Add a note on inorganic insecticides.  
**OR**
- a) Describe disadvantages of chemical pesticides. **7**
  - b) Explain techniques of fumigation. What are the different equipments used for insecticide application. **8**
- Q.4 Question based on Unit 3** **15**  
Describe in detail damage & control of any three house hold pests

OR

- a) Explain damage caused by and the control of *Sitophilusoryzae* 7  
b) Explain damage and control of bird louse & leaf hopper 8

**Q.5 Question based on Unit 4** 15  
Describe the role various larval stages of insects gathered during forensic investigation.

OR

- a) Explain entomophagy. 7  
b) Describe use of insect in tissue culture and genetic studies 8

**Q. 6 Question based on Unit 5** 15  
Explain the scope of NABARD with respect to Ento-entrepreneurship.

OR

- a) Write a note on KVIC scheme for apiculture w.r.t. finance. 7  
b) Scope of ento-entrepreneurship for a START-UP scheme. 8

**Q.7 Question based on Unit 6** 15  
Poona Transport purchased a truck on 1<sup>st</sup> June 2012 at Rs. 190000. One more truck they purchased on 31<sup>st</sup> Dec 2013 at Rs. 260000. The company sold parts of the truck on 31<sup>st</sup> March 2014 at Rs. 20000 which was purchased on 1<sup>st</sup> June 2012. The company charged 12% depreciation on 31<sup>st</sup> March every year under Reducing Balance Method.

- a) Show all necessary accounts.

OR

- b) Draw journal entries in the book of company.

OR

- a) What are the Golden rules in accounts. Discuss with suitable example. 7  
b) The following information related with Mr. Atul Jain Bank of Maharashtra for the month of June 2016. Prepare Bank reconciliation statement. 8

Date	Particulars
01	Balance as per passbook Rs. 12000/-
05	Cheque of Rs. 6000 issued to Mrs. Neeta but not yet presented.
11	Cheque of Rs. 10000 deposited into Bank but not yet cleared.
28	Cheque dishonored charges charged by bank Rs. 500/-
29	Cheque directly deposited by customer Rs. 2000/-
30	Bank deposited divided at Rs. 300 into our A/c
30	Bank charges deducted Rs. 150/-

- Q.8 Question based on Unit 7** **15**  
What is branding? Why branding is necessary for business.  
**OR**
- a) What is marketing and explain features of marketing. **7**  
b) Write a brief note on functions of marketing. **8**
- Q.9 Question based on Unit 8** **15**  
Question based on open unit(if opted)  
**OR**
- a) \_\_\_\_\_ **8**  
b) \_\_\_\_\_ **7**