



Second Semester Examination  
2024/2025 Academic Session

July/August 2025

**BET223 – Insect Ecology**  
**[Ekologi Serangga]**

Duration: 2 hours  
[Masa: 2 jam]

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Please ensure that this examination paper contains SIX (6) printed pages before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi ENAM (6) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

**Instructions:** Answer **FOUR (4)** out of **FIVE (5)** questions, in English or Bahasa Malaysia. Each question carries 25 marks.

**[Arahan:** Jawab **EMPAT (4)** daripada **LIMA (5)** soalan yang diberikan dalam Bahasa Inggeris atau Bahasa Malaysia. Tiap-tiap soalan bernilai 25 markah.]

In the event of any discrepancies, the English version shall be used.

*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]*

Should any candidate be caught cheating or in possession of materials not authorised to be brought into the Examination Hall during the examination, appropriate disciplinary action will be taken against the candidate concerned. In the event a candidate is found guilty of cheating, he/she can be expelled from the University.

*[Sekiranya seseorang calon didapati meniru/menipu ataupun mempunyai bahan-bahan yang tidak dibenarkan dibawa ke dalam Dewan Peperiksaan semasa peperiksaan diadakan, tindakan disiplin yang sewajarnya akan dikenakan terhadap calon berkenaan. Jika seseorang calon didapati bersalah meniru/menipu beliau boleh disingkir dari Universiti.]*

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1. [a] Discuss the types of dispersion patterns in insect populations, including the factors that affect each type.

*[Bincangkan jenis corak taburan dalam populasi serangga, termasuk faktor yang mempengaruhi setiap jenis.]*

(10 marks / 10 markah)

- [b] A group of cicadas was introduced to an island with no predators and plenty of food. At first, the population grew very quickly, but over time, the growth slowed down as food became limited. Eventually, the population size stayed about the same. Using a table, compare exponential and logistic population growth based on this case.

*[Sekumpulan riang-riang diperkenalkan ke sebuah pulau yang tiada pemangsa dan mempunyai banyak makanan. Pada mulanya, populasi berkembang dengan sangat cepat, tetapi lama kelamaan, pertumbuhannya menjadi perlahan apabila makanan menjadi terhad. Akhirnya, saiz populasi kekal lebih kurang sama. Menggunakan jadual, bandingkan pertumbuhan populasi eksponen dan logistik berdasarkan kes ini.]*

(15 marks / 15 markah)

2. [a] Compare the properties of qualitative and quantitative allelochemical compounds produced by host plants as defence mechanisms against insect predation.

*[Bandingkan sifat sebatian alelokimia kualitatif dan sebatian alelokimia kuantitatif yang dihasilkan oleh tumbuhan perumah sebagai mekanisme pertahanan terhadap serangan pemangsa serangga.]*

(10 marks / 10 markah)

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- [b] Feeding guilds of herbivorous insects are groups of species that exploit similar food resources and may occupy on a single host tree. Classify these herbivorous insects based on their feeding strategies and give an example for each.

*[Perseikatan pemakanan serangga herbivor merupakan kumpulan spesies yang mengeksploitasi sumber makanan yang serupa dan boleh mendiami satu pokok perumah yang sama. Kelaskan serangga herbivor ini berdasarkan strategi pemakanan mereka dan berikan satu contoh bagi setiap kumpulan.]*

(15 marks / 15 markah)

3. [a] Insects have been used in art and culture both symbolically and physically since ancient times. Discuss the ecological roles and behaviours of insects have influenced their representation in human culture.

*[Serangga telah digunakan dalam seni dan budaya secara simbolik dan fizikal sejak zaman dahulu. Bincangkan peranan ekologi dan tingkah laku serangga mempengaruhi perwakilan mereka dalam budaya manusia.]*

(10 marks / 10 markah)

- [b] Distinguish the methods used to measure pollination and seed dispersal processes by insects and other vertebrates.

*[Bezakan kaedah yang digunakan untuk mengukur proses pendebungaan dan penyebaran biji benih oleh serangga dan vertebrata lain.]*

(15 marks / 15 markah)

4. [a] Explain the ability of aquatic insects to enable them to live in water for most of their live cycle.

*[Terangkan keupayaan serangga akuatik yang membolehkan mereka hidup di dalam air pada sebahagian besar kitar hidupnya.]*

(10 marks / 10 markah)

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- [b] According to Table A, count the Family Biotic Index (FBI) value, then estimate the water quality rating. Determine the suitability of aquatic insects as a biological indicator for aquatic biomonitoring.

*[Berdasarkan Jadual A, hitung nilai 'Family Biotic Index (FBI)', kemudian anggarkan nilai kualiti air. Tentukan kesesuaian serangga akuatik sebagai penunjuk biologi untuk pemantauan biologi akuatik.]*

(15 marks / 15 markah)

Family Biotic Index (FBI) is calculated using this formula:

$$FBI = \frac{\sum (n \times t)}{N}$$

Where:

n = number of individuals in a taxon (e.g., family or genus)

t = tolerance value of that taxon (scale of 0 to 10; 0 = pollution sensitive, 10 = pollution tolerant)

N = total number of individuals

Table A

| Taxon             | No. of Individuals (n) | Tolerance Value (t) |
|-------------------|------------------------|---------------------|
| Mayfly            | 30                     | 1                   |
| Caddisfly         | 25                     | 2                   |
| Midge             | 20                     | 6                   |
| Deer fly          | 10                     | 8                   |
| Rat tailed maggot | 15                     | 10                  |

Water Quality Rating based on the Family Biotic Index (FBI):

| FBI Range | Water Quality | Pollution Level              |
|-----------|---------------|------------------------------|
| 0.00–3.75 | Excellent     | No apparent pollution        |
| 3.76–4.25 | Very Good     | Slight pollution             |
| 4.26–5.00 | Good          | Some pollution               |
| 5.01–5.75 | Fair          | Fairly significant pollution |
| 5.76–6.50 | Fairly Poor   | Significant pollution        |
| 6.51–7.25 | Poor          | Very significant             |
| >7.25     | Very Poor     | Severe pollution             |

Family Biotic Index (FBI) dikira menggunakan formula:

$$FBI = \frac{\sum (n \times t)}{N}$$

iaitu:

$n$  = jumlah individu setiap taksa (e.g., famili or genus)

$t$  = nilai toleransi setiap taksa (skala of 0 to 10; 0 = sensitif pencemaran, 10 = toleransi pencemaran)

$N$  = jumlah keseluruhan individu

Jadual A

| Taksa            | Jumlah individu (n) | Nilai toleransi (t) |
|------------------|---------------------|---------------------|
| Lalat mei        | 30                  | 1                   |
| Lalat kandul     | 25                  | 2                   |
| Agas             | 20                  | 6                   |
| Lalat rusa       | 10                  | 8                   |
| Lalat ekor tikus | 15                  | 10                  |

Nilai Kualiti Air berdasarkan Family Biotic Index (FBI):

| Julat FBI | Kualiti Air     | Aras Pencemaran             |
|-----------|-----------------|-----------------------------|
| 0.00–3.75 | Paling bersih   | Tiada pencemaran yang jelas |
| 3.76–4.25 | Sangat bersih   | Sedikit tercemar            |
| 4.26–5.00 | Bersih          | Tercemar                    |
| 5.01–5.75 | Sederhana       | Agak tercemar               |
| 5.76–6.50 | Sederhana kotor | Pencemaran ketara           |
| 6.51–7.25 | Kotor           | Sangat tercemar             |
| >7.25     | Sangat kotor    | Pencemaran teruk            |

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5. [a] Elaborate the advantages and disadvantages of using insects as bioindicators compared to other organisms.

*[Huraikan kebaikan dan kekurangan menggunakan serangga sebagai bioindikator berbanding organisma lain.]*

(10 marks / 10 markah)

- [b] Identify the mechanisms by which terrestrial insects respond to air pollution, provide examples of species used in monitoring and evaluate the effectiveness of using terrestrial insects as environmental bioindicators.

*[Kenal pasti mekanisme serangga daratan dalam bertindak balas terhadap pencemaran udara, berikan contoh spesies yang digunakan dalam pemantauan dan berikan penilaian terhadap keberkesanan menggunakan serangga daratan sebagai bioindikator alam sekitar.]*

(15 marks / 15 markah)

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