Date: 12/12/2016   Duration: 3 hrs.   Max Marks: 80 (40% weightage)

Note:
- **The question paper consists of two parts: Part I (Closed Book) and Part II (Open Book).**
- **Answer both parts in separate answer sheets. Part II will be given only on submission of Part I**
- **Each part consists of two sections: Section A and Section B. Do not jumble questions of Section A and B, else they will not be marked.**
- **Write crisp and to-the-point answers and elaborate only when required by the question.**

Max. Marks: 40 M   **PART- I (Closed Book)**   **Max. Duration: 90 Min**

-SECTION A-

Q1. Differentiate between the following pairs of reproductive isolation mechanisms: **[2+2=4M]**

(i) Ecological vs geographic isolation

(ii) Behavioural vs temporal isolation

Q2. What is meant by 'conservation of synteny'? How does it help evolutionary biologists? Explain with the help of a relevant example and diagram.   **[4M]**

Q3. How are wing eyespots advantageous to butterflies? Comment briefly on their origin during evolution.   **[4M]**

Q4. Differentiate among bryophytes, ferns, gymnosperms and angiosperms w.r.t. different evolutionary adaptations.   **[4M]**

Q5. Explain with the help of labeled diagram how brown alga evolved from red alga. [Hint: secondary emdosymbiosis occurred.]   **[2M]**

Q6. In a short paragraph, present your logical views on the debate: *Darwinism vs Creationism*.   **[2M]**

-SECTION B-

Q7. A) How are chelicerates different from mandibulates?   **[1M]**

B) Give a name of economically important annelid and the reason of its importance.   **[1M]**

C) Why are the cephalopods considered the most advanced of all the invertebrates?   **[2M]**

D) What are the advantages and disadvantages of the arthropod exoskeleton?   **[3M]**

Q8. A) You are having a discussion with your friend about the phylum Chordata. Your friend argues with you that as we don't show most of the chordate characters, its incorrect to group humans under the phylum chordata. Is your friend correct? Justify giving reasons. **[2M]**

B) What is the evidence for the surprisingly close relationship between echinoderms and chordates? Explain. **[2M]**

Q9. A) If a cow develops a preference for eating white four o'clock flowers and ignoring pink and red four o'clock flowers, what type of selection is being demonstrated? Sketch a graph of the curve with labeled axis to demonstrate the selection. **[1.5M]**

B) A population of birds, with various size beaks, eats seeds. Small seeds can be eaten by birds with small beaks. Larger, thicker seeds can only be eaten by birds with larger, thicker beaks. Suppose there is a shortage of small seeds but there are still many large seeds. a. Draw a new curve on the graph below to show how the distribution of beak sizes might change as a result of selection in this new environment. **[1.5M]**
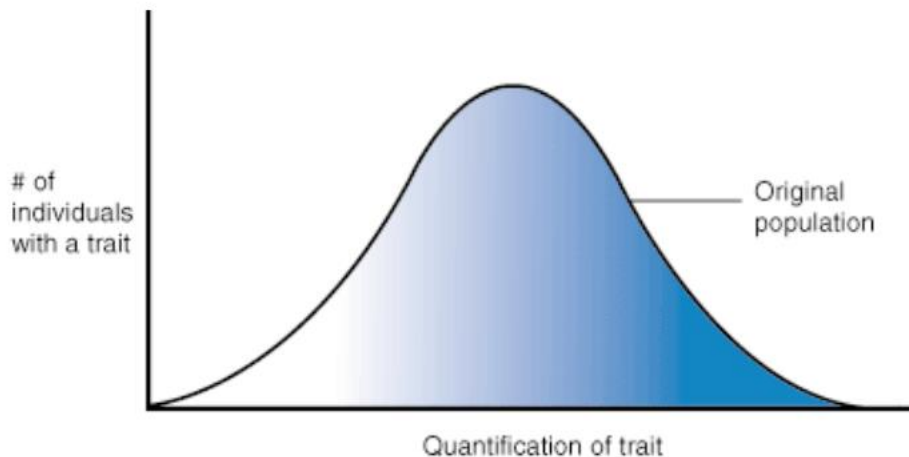
Q10. Comment on the following. Also, give the name the phyla exhibiting the given characteristic or component. **[1.5x4=6M]**

a) Water Vascular System   b) Nematocysts   c) Chaonocytes   d) Proglottids

Note: Do not jumble answers of Section A with those of Section B.

-SECTION A-

Q1. Explain the following statements: **[2+2=4M]**

   (i) Maintenance of nonsynonymous mutations by evolution leads to divergent selection.

   (ii) Removal of nonsynonymous mutations by evolution leads to stabilizing selection.

Q2. What are STRs? Explain with the help of a labeled diagram, how they are used in forensic investigations.   **[4M]**

Q3. (i) *Humans and chimps have >95% similar genomes.* In this context, explain why is it not advisable to always use medicines tested on chimps for treating human disorders.   **[2M]**

   (ii) Explain with the help of a labeled diagram how enhancers act during gene expression.

                                                                                          [2M]

Q4. Using relevant examples of *Ocimum* (tulsi) and *Artemisia* (plant from which antimalarial drug is extracted), elaborate briefly on the current challenges and trends in pharmaceutical research on medicinal plants.   **[4M]**

Q5. Explain with the help of labeled diagrams each of the following: **[2+2=4M]**

   (i) Mechanism of action of the anti-cancer molecule, taxol.

   (ii) The unusual phenomenon of schizogony.

-SECTION B-

Q6. A) If allele frequencies do not change from one generation to the next, is the population definitely in Hardy-Weinberg equilibrium? Why or why not?   **[2M]**

   B) West Nile virus (WNV) is a reemerging pathogen that causes severe flu like symptoms and fatal encephalitis in several species, including mouse and human. Recently, it was shown that the chemokine receptor CCR5 is critical for survival of mice infected with WNV. Glass & colleagues sequenced CCR5 genotypes in several hundred WNV patients in Arizona and Colorado, and compared them to another group of patients also exhibiting flu-like illnesses, but did not have West Nile. Below are the

distributions of genotypes in patients with and without West Nile: (CCR5Delta32 is a defective CCR5 allele)

Genotype	+/+	+/ Δ32	Δ32/ Δ32
Patients with West Nile:	316	62	17
Patients without West Nile	125	19	1

Referring to the West Nile virus information given above, what was the frequency of the normal CCR5 and CCR5-delta32 allele in both of these patient cohorts? The CCR5-delta32 allele is at Hardy-Weinberg equilibrium in the North American population at large. Does either patient population appear to be in Hardy-Weinberg equilibrium? **[4M]**

Q7. A) If you found an eel-like animal at the beach, what features would you look for in deciding whether you had a hagfish or an eel (a true fish)? **[2M]**

B) Suppose lancelets lacked a gene found in tunicates and vertebrates. Would this imply that the chordates most recent ancestor also lacked this gene. Explain **[2M]**

Q8. Given below are the survival and reproductive rate of the three genotypes. Calculate the relative fitness of each genotype. **[2M]**

	DD	Dd	dd
Survival Rate	10%	10%	20%
Reproductive Rate	10	8	6

Q9. A) Sponge is the simplest of the animals and are seem just an aggregate of cells. What features make it seem like a single organism? **[1.5M]**

B) What evolutionary advantages does segmentation confer upon an organism? **[1.5M]**

Q10. What challenges were faced for transition of life from aquatic environment to terrestrial environment? How these challenges were overcome? **[3M]**