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| YEAR 13 BIOLOGY OVERVIEW 2020 – Home Study For Students | | | | | | |
| Term 1 – Strand 1: Animal Behaviour | | | | | | |
| **Major Learning Outcome:** Students are able to demonstrate an understanding of **biological concepts and processes** relating animal behaviour to biotic and abiotic environmental factors and how the behaviour **contributes to the organisms’s survival.** | | | | | | |
| **Key Learning Outcome:** Students are able to demonstrate an understanding of the ecological niche of an animal species and to investigate and report an aspect of the animal species’ ecological niche.   * ecological niche is defined as the role of an organism in a community in terms of the habitat it occupies, its interactions with other organisms, and its effect on the environment. * adaptive features refer to structural, behavioural, and physiological * environment refers to biotic and abiotic factors   an investigation is an activity which includes: a statement of the purpose (hypothesis); testable question or prediction; collecting, recording, and process data relevant to the hypothesis; and interpreting and reporting the findings in a scientific report. | | | | | | |
| **Key Learning outcome**: Students are able to demonstrate an understanding of timing responses and ways of representing and interpreting timing responses.   * timing responses (daily, tidal, lunar, annual) as determined by the movement of earth, sun, moon; diurnal, nocturnal, crepuscular * biological rhythms (circadian, circatidal, circalunar, circannual) * biological clock (in the brain) providing endogenous control (via melatonin) of rhythms and which is set by environmental cues (zeitgebers). | | | | | | | |
| **Sub-**  **strand** | **Week & Date** | **SLO #** | **Specific Learning Outcomes: *Students are able to*** | **Skill level** | **Resources** | **Assessments** | |
| **1.3 Timing Responses** | Week 9  30th March – 3rd April | 1 | Define biological timing (responses)/biological clocks | 1 | Text Book  Handout  Internet | Lesson Activity: 1.3B  1.3C  1.3D  Home Test 1  (17%) | |
| 2 | Describe the function of a biological clock. | 2 |
| 3 | Define diurnal/nocturnal/crepuscular | 1 |
| 4 | Identify diurnal/nocturnal/crepuscular activity in a given context | 1 |
| 5 | Define endogenous/exogenous biological rhythms | 1 |
| 6 | Define actograms/free running period/phase shift/zeitgeber | 1 |
| 7 | Identify zeitgeber/endogenous/exogenous rhythmic activity in a given context | 1 |
| 8 | Explain the activity diagrams (actograms) of an organism using the following terms: free-running period, phase shift, zeitgeber | 3 |
| 9 | Discuss the implications of environmental destruction on biological clocks and survival of named organisms | 4 |
| 10 | Describe a rhythmic cycle (daily, tidal, lunar, annual) | 2 |
| 11 | Explain the adaptive value of a biological timing response (daily, tidal, lunar, annual) on the life cycle of an organism | 3 |
| 12 | Define circadian/circa tidal/circalunar/circannual biological rhythms | 1 |
| 13 | Identify circadian/circatidal/circalunar/circannual biological rhythms in a given context | 1 |
| 14 | Contrast the different biological rhythms (circadian, circatidal, circalunar, circannual) using examples | 3 |
| 15 | Discuss the importances of different biological rhythms (circadian/circatidal/circalunar/circannual) for a named organism | 4 |

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| **Key Learning outcome**: Students are able to demonstrate understanding of interspecific interactions and ways in which these interactions influence survival in the niches   * competition for resources (named e.g. food, living space, etc.) acting to limit numbers and distribution (fundamental niche versus realised / actual niche; zonation) of competing species; out-competition leading to niche differentiation * predator-prey relationships and cycles acting to control numbers and distribution (fundamental niche versus realised / actual niche; zonation) of both predator and prey species | | | | | | |
| **Sub-**  **Strand** | **Week & Date** | **SLO#** | **Specific Learning Outcomes:** *Students are able to:* | **Skill level** | **Resources** | **Assessments** |
| **1.4 Interspecific Interactions** | Week 10  6th – 10th April | 1 | Define niche differentiation/out-competition/interspecific competition | 1 | Text Book  Handout  Internet | Lesson Activity:  1.4A  1.4B  Home Test 2  (9%) |
| 2 | State the competitive exclusion principle | 1 |
| 3 | Identify niche differentiation in a given context | 1 |
| 4 | Identify interspecific competition in a given context | 1 |
| 5 | Identify out-competition in a given context | 1 |
| 6 | Describe the features of competitions | 2 |
| 7 | Explain how interspecific competition limit the numbers of a population | 3 |
| 8 | Explain how interspecific competition leads to niche differentiation | 3 |
| 9 | Explain how interspecific competition leads to species distribution | 3 |
| 10 | Discuss how interspecific competition contribute to species redistribution, population numbers and niche differentiation using named examples | 4 |
| 11 | Describe the features of predator-prey relationships | 2 |
| 12 | Explain how predator-prey relationships contribute to cycles acting to control numbers and distribution of both predator and prey species | 3 |
| 13 | Discuss the impacts of a number of predators – prey relationships working together within a population on population numbers, food availability, and species distribution. | 4 |

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| **Key Learning outcome**: Students are able to demonstrate an understanding of intraspecific interactions and ways in which these interactions influence survival in the niches   * advantages ( eg co-operative behaviour such as hunting/defence / detecting predators; finding food; parental care; mate availability) and disadvantages (eg increased intraspecific competition / aggressive encounters) of group living * social organisation; hierarchies (linear and complex); advantages (reduction of serious aggression; controlled access to resources) and disadvantages (uneven access to resources); dominance and submissive behaviours in maintaining hierarchies * territory and home range * reproductive behaviour: r and k strategies; monogamous and polygamous mating; courtship, mating, and parental care | | | | | | |
|  |  | **SLO#** | **Specific Learning Outcomes:** *Students are able to* | **Skill level** | **Resources** | **Assessments** |
| **1.5 Intraspecific interactions** | Week 11  13th – 17th April | 1 | Define *r* and *k* strategies/monogamous and polygamous mating/social organisations | 1 | Textbook  Handout  Internet | Lesson Activity:  1.5A  1.5B  1.5C  Home Test 3  (20%) |
| 2 | Identify *r* or *k* strategies in a given context | 1 |
| 3 | Identify monogamous or polygamous mating in a given context | 1 |
| 4 | Identify/state a feature or an example of social organisation in a given context | 1 |
| 5 | List the advantages and disadvantages of group living | 2 |
| 6 | Explain how group living influence survival of members group | 3 |
| 7 | Describe the features of *r* and *k* strategies | 2 |
| 8 | Explain how reproductive behaviour influence survival | 3 |
| 9 | Discuss how the different reproductive behaviours (*r* and *k* strategies; monogamous and polygamous mating; courtship and parental care) work together to influence the survival of a named species, using examples | 4 |
| 10 | List the advantages and disadvantages of different types of parental care | 2 |
| 11 | Describe the features of different types of social organisations | 2 |
| 12 | Outline the reasons for different types of social organisations | 2 |
| 13 | Discuss the evolution of group living and evaluate whether group living continues to be an advantage under changing social and environmental conditions | 4 |
| 14 | Describe the features of social organisation in terms of hierarchies and dominance and submissive behaviours | 2 |
| 15 | Outline the advantages and disadvantages of different types of social organisations | 2 |
| 16 | Explain how dominance and submissive behaviours maintain hierarchies social organisation | 3 |
| 17 | Analyse / sequence the hierarchal order of social organisations. | 3 |
| 18 | Define territory and home range | 1 |
| 19 | Explain how the establishment of territory and home range increases survival of a species | 3 |
| 20 | Discuss the social organisations of a number of species living together within an area and how these organisation support survival or threaten extinction, and how members of these species cope | 4 |

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| **Term 1 & 2: Strand 2 - Gene Expression** | | | | | | |
| **Major Learning Outcome 2:**  Students are able to describe, explain and discuss **biological concepts and processes** relating to gene expression. | | | | | | |
| **Key Learning outcome**: Students are able to demonstrate an understanding of the DNA structure and replication and ways in which these influence DNA functioning   * genome * structure of the gene  replication of DNA – revision and extension of form 6 to include: semi-conservative replication, enzyme control (helicase, DNA polymerase, ligase), strands, leading and lagging strands, Okazaki fragments and synthesis occurring in the 5 to 3’ direction. | | | | | | |
| **Sub-**  **Strand** | **Week**  **& Date** | **SLO#** | **Specific Learning Outcomes:** *Students are able to* | **Skill level** | **Resources** | **Assessments** |
| **2.1 DNA structure and replication** | Week 12  20th – 24th April | 1 | Define genome | 1 | Textbook  Handout  Internet | Lesson Activity -  Lesson 1: The Genome  Lesson 2: DNA Replication  Home Test 4  (15%) |
| 2 | Identify / State a feature or example of a genome in a given context | 1 |
| 3 | Describe the structure of a gene or DNA | 2 |
| 4 | Explain how the genome determines full characteristics of an organism | 3 |
| 5 | Define semi-conservative replication | 1 |
| 6 | Identify semi-conservative replication , in a DNA replication representation | 1 |
| 7 | Identify the leading and lagging strand in a DNA replication representation. | 1 |
| 8 | Describe the direction of the synthesis of the new strand [in the 5’ to 3’ direction] | 2 |
| 9 | Describe the structure and replication of DNA in terms of semi-conservative replication, enzyme control, antiparallel 3’ – 5’ strands | 2 |
| 10 | Explain the roles of respective enzymes in DNA Replication [Helicase/DNA Polymerase/Ligase]. | 3 |
| 11 | Explain the process of DNA Replication in terms of the leading and lagging strands and the Okazaki fragments | 3 |
| 12 | Discuss the process of DNA Replication of the lagging and leading strand and Okazaki fragments, with the help of enzymes(helicase/polymerase/ligase) | 4 |
| 13 | Describe ways in which DNA Replication problems may arise. | 2 |

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| **Key Learning outcome**: Students are able to demonstrate an understanding of protein structure, functions and synthesis and how these contribute to forms and functions   * protein structure (primary, secondary, tertiary) and function (structural e.g. collagen, keratin, and regulatory e.g. enzymes, hormones) * protein synthesis; transcription and translation – revision and extension of form 6 to include the role of DNA (triplets), mRNA (codons), tRNA (anticodons), ribosomes; use of codon dictionary to identify amino acids; redundant nature of the genetic code * protein structure (primary, secondary, tertiary) and function (structural e.g. collagen, keratin, and regulatory eg enzymes, hormones) * protein synthesis; transcription and translation – revision and extension of form 6 to include the role of DNA (triplets), mRNA (codons), tRNA (anticodons), ribosomes; use of codon dictionary to identify amino acids; redundant nature of the genetic code | | | | | | |
| **Sub-**  **Strand** | **Week**  **& Date** | **SLO#** | **Specific Learning Outcomes:** *Students are able to* | **Skill level** | **Resources** | **Assessments** |
| **2.2 Protein structure, function, and synthesis** | Week 13  27th April – 1st May | 1 | Define transcription/translation | 1 | Textbook  Handout  Internet | Lesson Activity –  Lesson 1: Protein Synthesis  Lesson 2: Protein Structure & Function  Home Test 5  (17%) |
| 2 | Define codons/anticodons | 1 |
| 3 | State the function of mRNA/tRNA/rRNA | 1 |
| 4 | Identify transcription in a given representation of protein synthesis | 1 |
| 5 | Identify translation in a given representation of protein synthesis | 1 |
| 6 | Identify codons/anticodons in a given representation of protein synthesis | 1 |
| 7 | Identify mRNA/tRNA in a given representation of protein synthesis | 1 |
| 8 | Define protein synthesis | 1 |
| 9 | Identify/State a feature of protein synthesis, within a given context | 1 |
| 10 | Describe the process of protein synthesis [Transcription /Translation] | 2 |
| 11 | Describe the use of the Genetic Code to identify amino acids | 2 |
| 12 | Describe the redundant nature of the genetic code | 2 |
| 13 | Explain the relationships within transcription and translation including the role of DNA (triplets), mRNA (codons), tRNA (anticodons), ribosomes; use of codon dictionary to identify amino acids; redundant nature of the genetic code | 3 |
| 14 | Discuss the interdependency of the different parts of the process of protein synthesis (transcription and translation including the role of DNA (triplets), mRNA (codons), tRNA (anticodons), ribosomes; use of codon dictionary to identify amino acids; redundant nature of the genetic code | 4 |
| 15 | Describe the features of structural protein/ functional protein | 2 |
| 16 | Relate protein structure to its function (structural eg collagen, keratin, and functional e.g. enzymes, hormones) | 3 |
| 17 | Discuss the importance of protein structure to different forms and functions in plants and/or animals | 4 |

**TERM 2**

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| **Key Learning Outcome**: Students are able to demonstrate an understanding of mutations andways in which these influence DNA functioning.   * mutations * gene (point) mutations - the substitution of bases producing missense (different amino acid) or nonsense codons (termination); addition or deletion of bases producing a frameshift (as all following amino acids changed leading to early termination). * chromosome (block) mutations – deletion, inversion, duplication, translocation of genes in and between chromosomes * aneuploidy – change in number of chromosomes within a set resulting from nondisjunction during meiosis eg Downs (trisomy 21), Turners, Kleinfelters syndromes * polyploidy – change in numbers of (whole) sets of chromosomes resulting from complete non-disjunction during meiosis eg triploid (3n), tetraploid (4n); autopolyploidy, allopolyploidy | | | | | | |
| **Sub-Strand** | **Week & Date** | **SLO#** | **Specific Learning Outcomes: *Students are able to*** | **Skill level** | **Resources** | **Assessments** |
| **2.3 Mutations** | Week 1 – 3  18th May – 5th June | 1 | Define mutation | 1 | Textbook  Handout  Internet | Lesson Activity –  Lesson 1: Gene Mutations  Lesson 2:  Chromosomal Mutations  Lesson 3:  Aneuploidy  Lesson 4: Polyploidy  Home Test 6  (20%) |
| 2 | Describe the features of mutations and give examples | 2 |
| 3 | Describe gene (point) mutations (substitution of bases producing missense or nonsense codons; addition or deletion of bases producing a frameshift). | 2 |
| 4 | Describe chromosome (block) mutations (deletion, inversion, duplication, translocation of genes in and between chromosomes) | 2 |
| 5 | Explain the causes of gene (point) mutations | 3 |
| 6 | Differentiate between chromosome mutation and gene mutation | 3 |
| 7 | Explain the causes and effects of chromosome (block) mutations | 3 |
| 8 | Discuss the impact of gene (point) mutations on the functioning of an affected person using named examples | 4 |
| 9 | Discuss the impact of chromosome (block) mutations on an affected person using named examples | 4 |
| 10 | Define polyploidy | 1 |
| 11 | Define auto polyploidy, allopolyploidy | 1 |
| 12 | Describe the characteristics of polyploidy (change in numbers of (whole) sets of chromosomes resulting from complete non-disjunction during meiosis eg triploid (3n), tetraploid (4n); autopolyploidy, allopolyploidy) | 2 |
| 13 | Compare and contrast autopolyploidy with allopolyploidy | 3 |
| 14 | Explain the effects of polyploidy on the genome | 3 |
| 15 | Discuss the impact of polyploidy on an affected individual using examples | 4 |
| 16 | Define triploid (3n) | 1 |
| 17 | Compare and contrast the features of triploid with tetraploid | 3 |
| 18 | Define Non-Disjunction | 1 |
| 19 | Define tetraploid (4n) | 1 |
| 20 | Define Aneuploidy | 1 |
| 21 | Explain the effects of aneuploidy on the genome | 3 |
| 22 | Discuss the impact of aneuploidy on an affected individual using examples | 4 |
| 23 | Identify from a given representation or a karyotype if a person is suffering from Down’s Syndrome/Turner’s Syndrome/Klinefelters Syndrome. | 1 |
| 24 | Describe the chromosomal characteristics of a person suffering from Down’s Syndrome/Turner’s Syndrome/Klinefelter’s Syndrome | 2 |
| 25 | Describe the common physical characteristics of a person suffering from Down’s syndrome/Turner’s syndrome/Kleinfelter’s syndrome | 2 |
| 26 | Compare the features of Down’s syndrome, Turner’s syndrome and Kleinfelter’s syndrome | 3 |
| 27 | Define deletion, inversion, duplication, translocation of genes | 1 |
| 28 | Differentiate between the terms missense codons and nonsense codons | 3 |

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| **Key Learning Outcome**: Students are able to demonstrate an understanding of metabolic pathways, linkages and sex linkages and ways in which these influence DNA functioning   * metabolic pathways eg. PKU * effects of mutation on enzyme control of metabolic pathways * linkage and sex linkage   inheritance of: red-green colour blindness in humans; haemophilia in humans | | | | | | |
| **Sub-**  **Strand** | **Week**  **& Date** | **SLO#** | **Specific Learning Outcomes: *Students are able to*** | **Skill level** | **Resources** | **Assessments** |
| **2.4 Metabolic Pathways, Genetic Linkages and Sex Linkages** | Week 4  8th – 12th June | 1 | Define metabolic pathway | 1 | Textbook  Handout  Internet | Lesson Activity -  Lesson 1: Metabolic Pathways  Lesson 2: Linkage & Sex Linkage  Home Test 7  (19%) |
| 2 | Describe the characteristics of phenylketonuria (PKU) | 2 |
| 3 | Explain the relation between metabolic pathways disorder and PKU | 3 |
| 4 | Represent diagrammatically the metabolic pathway for PKU | 3 |
| 5 | Explain the effects of untreated PKU | 3 |
| 6 | Explain the effects of mutation on enzyme control of metabolic pathways | 3 |
| 7 | Interpret the effects of mutation on enzyme control of metabolic pathways based on given information | 3 |
| 8 | Define the term  **genetic linkage /sex linkage** | 1 |
| 9 | Identify/State a feature or example of sex-linked conditions, in a given context | 1 |
| 10 | Describe the difference between Sex Linkage and Genetic Linkage | 2 |
| 11 | Describe the process of genetic likage and sex linkage | 2 |
| 12 | Describe the process of inheritance of red-green colour blindness/haemophilia in humans as an example of sex linkage | 2 |
| 13 | Describe an example of genetic linkage in humans | 2 |
| 14 | Compare linked genes to sex linked genes/sex linkage to genetic linkage | 3 |
| 15 | Discuss linkage and sex linkage as the biological basis of heredity | 4 |
| 16 | Explain using a punnet square the process of inheritance of sex linkage [haemophilia and colour blindness] | 3 |
| 17 | Discuss using examples of the complications associated with the inheritance of colour blindness/haemophilia | 4 |

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| **Key Learning Outcome**: Students are able to demonstrate an understanding of gene-gene interactions and Mendelian inheritance and ways in which these influence DNA functioning   * gene-genene interactions: collaboration, epistasis (complementary; supplementary genes); polygenes (eg height and skin colour in humans); pleiotrophy (eg sickle cell disease)   monohybrid and dihybrid crosses with: complete dominance, incomplete dominance, codominance, multiple alleles, test cross (genes, alleles, genotype, phenotype, homozygous, heterozygous) – revision of form 6 | | | | | | |
| **Sub-**  **Strand** | **Week &**  **Date** | **SLO#** | **Specific Learning Outcomes: *students are able to*** | **Skill level** | **Resources** | **Assessments** |
| 2.5 Gene – Gene Interactions and Mendelian Inheritance 2.5  Gene-gene  Interactions  and  Mendelian  Inheritance | Week 5 – 6  15th – 26th June | 1 | Define monohybrid cross / dihybrid crosses | 1 | Textbook  Handout  Internet | Lesson Activity –  Lesson 1: Mendelian Inheritance with Monohybrid Crosses  Lesson 2: Gene-gene interactions  Home Test 8  (8%) |
| 2 | Define complete dominance/incomplete dominance/co-dominance, | 1 |
| 3 | Define multiple alleles / homozygous / heterozygous | 1 |
| 4 | Identify/State a feature or example of monohybrid cross/dihybrid crosses, in a given context | 1 |
| 5 | Identify/State a feature or example of complete dominance/incomplete dominance/co-dominance, in a given context | 1 |
| 6 | Identify/State a feature or example of multiple alleles / homozygous /heterozygous gene pairs, in a given context. | 1 |
| 7 | Identify or state a feature of a heterozygous gene pair in a given context. | 1 |
| 8 | Describe genotypes for monohybrid crosses with complete dominance, incomplete dominance, co-dominance, multiple alleles, test cross (genes, alleles, homozygous, heterozygous) | 2 |
| 9 | Explain the expression of characteristics from monohybrid crosses involving complete dominance, incomplete dominance, codominance, (genes, alleles, genotype, phenotype, homozygous, heterozygous) | 3 |
| 10 | Discuss the full picture of the inheritance of named characteristics through monohybrid and dihybrid crosses using named plants and or animals | 4 |
| 11 | Define the term epistasis. | 1 |
| 12 | Define the term complementary gene | 1 |
| 13 | Define the term supplementary gene. | 1 |
| 14 | Define the terms pleiotropy/polygene | 1 |
| 15 | Identify/State a feature or example of gene interactions / collaboration / epistasis (complementary; supplementary genes) / polygenes (e.g. height and skin colour in humans); pleiotropy, in a given context | 1 |
| 16 | Describe the process of gene – gene interactions with complementary genes | 2 |
| 17 | Describe the process of gene – gene interactions with supplementary genes | 2 |
| 18 | Describe the process of gene – gene interactions involving polygenes genes | 2 |
| 19 | Describe the process of gene – gene interactions involving pleiotropy | 2 |
| 20 | Explain height and skin colour in humans in terms of gene – gene interactions (e.g. sickle cell disease) | 3 |
| 21 | Explain sickle cell disease in humans in terms of gene – gene interactions | 3 |
| 22 | Explain the difference between complementary gene and supplementary gene using appropriate examples | 3 |
| 23 | Discuss the type of epistasis shown using the phenotypic ratio from a dihybrid cross | 4 |
| 24 | Discuss the interrelationship between gene – gene interactions in determining various characteristics in humans and the impact of these characteristics on survival. | 4 |

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| Strand 3: Biotechnology Applications | | | | | | |
| **Major Learning Outcome 3:**  Students are able to describe, explain and discuss **biotechnology applications** and **the human needs and demands** for the applications. | | | | | | |
| **Key Learning Outcome:** Students are able to demonstrate an understanding of gene cloning, transgenesis and DNA profiling and ways in which these influence gene functioning   * the formation of recombinant DNA using techniques of restriction enzymes and ligation * the use of bacterial plasmids to produce multiple copies of the desired gene * transgenesis using techniques of Agrobacterium tumefaciens; ballistic (‘gene gun’) method; pronuclear (‘micro’) injection; viral vectors  formation of DNA profiles using the techniques of PCR and gel electrophoresis | | | | | | |
| **Sub-**  **Strand** | **Week &**  **Date** | **SLO#** | **Specific Learning Outcomes: *Students are able to*** | **Skill level** | **Resources** | **Assessments** |
| **Sub-strand 3.1 – Gene cloning, Transgenesis, and DNA Profling** | Week 7 – 8  29th June – 10th July | 1 | Define gene cloning/trans genesis/ bacterial plasmids | 1 | Textbook  Handout  Internet | Lesson Activity: 3.1A  3.1B  3.1C  3.1D  Home Test 9  (15%) |
| 2 | Identify gene cloning/trans genesis/ bacterial plasmids, in a given context | 1 |
| 3 | Describe the steps of using bacterial plasmids to produce multiple copies of the desired gene | 2 |
| 4 | Define *Agrobacterium* *tumefaciens* | 1 |
| 5 | Describe transgenesis using the technique of  *Agrobacterium* *tumefaciens* | 2 |
| 6 | Explain the positive and negative impacts of the use of trans genesis on the gene pool for a population | 3 |
| 7 | Discuss the positive and negative impacts of the use of transgenesis on the human gene pool | 4 |
| 8 | Discuss how recombinant DNA is formed using restriction enzymes and ligation and its impacts (benefits and dangers) on the transgenic organism. | 4 |
| 9 | Define short tandem repeat (STR) in DNA | 1 |
| 10 | Describe why every person’s DNA is unique in terms of STRs | 2 |
| 11 | Define DNA profiling | 1 |
| 12 | Identify DNA profiling in a given context | 1 |
| 13 | Define PCR / gel electrophoresis | 1 |
| 14 | Identify PCR / gel electrophoresis in a given context | 1 |
| 15 | Describe the formation of DNA profiles using the techniques of PCR | 2 |
| 16 | Describe the formation of DNA profiles using the techniques of gel electrophoresis | 2 |
| 17 | Explain the interrelationships of processes in the formation of DNA profiles using the techniques of PCR and gel electrophoresis | 3 |
| 18 | Explain the positive and negative impacts of DNA profiling on medical health sciences | 3 |
| 19 | Discuss how DNA profiling has made the work of criminal justice easier. | 4 |
| 20 | Discuss the impact of the formation of DNA profiles using the techniques of PCR and gel electrophoresis on criminal justice, medicine and other areas | 4 |

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| Strand 4: Processes and Patterns of Evolution | | | | | | |
| Major Learning Outcome 4:Students are able to describe, explain and discuss processes and patterns of evolution | | | | | | |
| **Key Learning Outcome:** Students are able to demonstrate an understanding of the different types of variations,the causes of these variations and the circumstances that give rise to variation.   * role of mutation as a source of new alleles * role of meiosis in producing variation and recombinant genotypes/gametes (independent assortment, segregation, crossing over) – revision and extension of form 6 * role of fertilisation in sexual reproduction in producing variation  importance of variation in evolution | | | | | | |
| **Sub-**  **Strand** | **Week & Date** | **SLO#** | **Specific Learning Outcomes:***Students are able to* | **Skill level** | **Resources** | **Assessments** |
| **4.1 Variation** | Week 9  13th – 17th July | 1 | Define the terms independent assortment / segregation / crossing over / recombinant genotypes | 1 | Textbook  Handout  Internet | Lesson 1: Variation  Lesson 2: Role of variation in evolution  Home Test 10  (15%) |
| 2 | Identify/State a feature or example of independent assortment / segregation / crossing over / recombinant genotypes, in a given context | 1 |
| 3 | Describe the process of independent assortment/segregation/crossing over during meiosis. | 2 |
| 4 | Explain how independent assortment/segregation/crossing over during meiosis contributes to variation. | 3 |
| 5 | Describe the process of mutation that leads to the formation of new alleles | 2 |
| 6 | Explain the contribution of mutation to the gene pool of the population | 3 |
| 7 | Discuss the positive and negative impacts of mutation on a population | 4 |
| 8 | Identify the processes of meiosis and mitosis from a given context. | 1 |
| 9 | Identify/State a feature or example of meiosis / gametes / fertilisation / mitosis, in a given context | 1 |
| 10 | Describe the process of fertilisation in terms of the combination of chromosomes from gametes | 2 |
| 11 | Explain how fertilization in sexual reproduction produces variation | 3 |
| 12 | Discuss the role of fertilization in sexual reproduction in producing variation and enhancing biological success, using named examples. | 4 |
| 13 | Define evolution | 1 |
| 14 | Identify/State a feature or example of evolution, in a given context | 1 |
| 15 | List the key features of the process of evolution | 2 |
| 16 | Explain the importance of variation in evolution | 3 |
| 17 | Discuss the impact of evolution on the survival of species and the critical role of variation in promoting evolution | 4 |

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| **Key Learning Outcome:** Students are able to demonstrate an understanding of natural selection and factors that influence this, and things that are impacted by natural selection   * theory of natural selection as proposed by Darwin; selecting agents/selection pressures (eg predators) * sexual selection as a special case of natural selection – females act as the selecting agent for which males (strongest / biggest / most showy / healthiest ) will breed * artificial selection (selective breeding) – humans act as the selecting agent for which plants and animals (those with the desirable traits) will breed   ‘fitness’ in terms of the organisms which breed successfully to produce the most offspring, so their alleles increase in frequency in the gene pool | | | | | | |
| **Sub-strand 4.2 Natural Selection** | Week 10  20th – 24th July | **SLO#** | **Specific Learning Outcomes:***Students are able to* | **Skill level** | **Resources** | **Assessments** |
| 1 | Define natural selection, selection pressure, sexual selection | 1 | Textbook  Handout  Internet | Lesson 1: Natural Selection  Lesson 2: Sexual Selection  Lesson 3: Artificial Selection  Home Test 11  (15%) |
| 2 | Identify/natural selection / selection pressure / sexual selection, in a given context | 1 |
| 3 | Outline the main points of the theory of natural selection as proposed by Darwin; | 2 |
| 4 | List the selecting agents for selection pressures[biotic and abiotic factors] that contribute to natural selection | 2 |
| 5 | Explain with examples of how biotic and abiotic factors act as forces of Natural Selection | 3 |
| 6 | Explain the related ideas in the theory of natural selection as proposed by Darwin | 3 |
| 7 | Evaluate the theory of natural selection as proposed by Darwin; presenting your own opinion on the relative truth of the theory | 4 |
| 8 | Outline the main features of sexual selection as a special case of natural selection (females act as the selecting agent for which males (strongest /biggest/ most showy/healthiest) will breed) | 2 |
| 9 | Explain the interrelationships within the sexual selection as a special case of natural selection | 3 |
| 10 | Discuss the impact of sexual selection on populations using specific examples[limit your example to Peacocks/Wolves] | 4 |
| 11 | Define selective breeding | 1 |
| 12 | Identify/State a feature or example of selective breeding, in a given context | 1 |
| 13 | Describe the features of artificial selection or selective breeding | 2 |
| 14 | Explain the role of humans in artificial selection (selective breeding) | 3 |
| 15 | Discuss the impact of artificial selection (selective breeding) on variations in populations | 3 |
| 16 | Compare the ‘effectiveness’ of methods of sexual selection and selective breeding in terms of their contribution to variations in populations | 3 |
| 17 | Define ‘fitness’ | 1 |
| 18 | Identify/State a feature or example of fitness, in a given context | 1 |
| 19 | Explain how ‘fitness’ contributes to frequency of alleles in the gene pool | 3 |
| 20 | Evaluate the contribution of natural selection, sexual selection and selective breeding on a population, providing an opinion on the preferred method | 4 |

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| **Key Learning Outcome:** Students are able to demonstrate an understanding of gene pools and allele frequencies within gene pools of a population and factors that affect allele frequency.   * gene pool as the sum total of genes within a population * allele frequency as to how often an allele occurs in a gene pool; factors affecting allele frequency - the size of the population; natural selection, sexual selection, migration (gene flow) * genetic drift – the changes in allele frequency in a population by chance, related to population size * founder effect and bottleneck effect as special cases of genetic drift | | | | | | |
| **Sub-strand 4.3 Gene pool and allele frequency** | Week 11  27th – 31st July | **SLO#** | **Specific Learning Outcomes:***Students are able to* | **Skill level** | **Resources** | **Assessments** |
| 1 | Define gene pool / allele frequency | 1 | Textbook  Handout  Internet | Lesson 1: Allele frequency  Lesson 2: Genetic Drift  Lesson 3: Founder Effects and Bottleneck  Home Test 12  (15%) |
| 2 | Define founder effect / bottleneck effect | 1 |
| 3 | List the factors that affect allele frequency within a population | 2 |
| 4 | Describe how certain factors such a population size, natural selection and gene flow affects the allele frequency. | 2 |
| 5 | Explain how the size of a population affects allele frequency | 3 |
| 6 | Explain how natural selection affects allele frequency | 3 |
| 7 | Explain how migration (gene flow) affect allele frequency | 3 |
| 8 | Define genetic drift | 1 |
| 9 | Identify/State a feature or example of genetic drift, in a given context | 1 |
| 10 | Explain how genetic drifteffect changes in allele frequency in a population by chance | 3 |
| 11 | Explain how genetic drift is related to or affected by population size | 3 |
| 12 | Discuss the impact of genetic drift on populations and population size | 4 |
| 13 | Describe the features of the founder effect as special cases of genetic drift | 2 |
| 14 | Describe the features of the bottleneck effect as special cases of genetic drift | 2 |
| 15 | Explain the relation between the founder effect and bottleneck effect as special cases of genetic drift | 3 |
| 16 | Discuss the impacts of the founder effect and bottleneck effect as special cases of genetic drift | 4 |

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| **Key Learning Outcome:** Students are able to demonstrate an understanding of the different types of speciation, the different reproductive isolating mechanisms and the impact of speciation on diversity   * allopatric, sympatric, instant (polyploidy) speciation * reproductive isolating mechanisms :   + pre-mating (pre-zygotic) – geographical, ecological, behavioural, structural, temporal   + post-mating (post-zygotic) – hybrid inviable, hybrid sterile, hybrid breakdown. | | | | | | |
| **Sub-strand 4.4 Speciation** | Week 12  3rd – 7th August | **SLO#** | **Specific Learning Outcomes: *Students are able to*** | **Skill level** | **Resources** | **Assessments** |
| 1 | Define allopatric / sympatric / speciation | 1 | Textbook  Handout  Internet | Lesson 1: Speciation  Lesson 2: Reproductive Isolating Mechanisms  Lesson 3: Post-zygotic  Home Test 13  (15%) |
| 2 | Identify an example of allopatric/sympatric / speciation, in a given context | 1 |
| 3 | Describe the features of allopatric and sympatric speciation | 2 |
| 4 | Describe the difference between allopatric and sympatric speciation | 2 |
| 5 | List the pre-mating and the pre-zygotic reproductive isolating mechanisms | 2 |
| 6 | Describe the features of each reproductive isolating mechanism | 2 |
| 7 | Explain why geographical isolation leads to reproductive isolation | 3 |
| 8 | Explain why ecological isolation leads to reproductive isolation | 3 |
| 9 | Explain why behavioural isolation leads to reproductive isolation | 3 |
| 10 | Explain why structural isolation leads to reproductive isolation | 3 |
| 11 | Explain why temporal isolation leads to reproductive isolation | 3 |
| 12 | Define hybrid inviable/hybrid sterile/hybrid breakdown | 1 |
| 13 | Identify/State a feature or example of hybrid inviable / hybrid sterile/hybrid breakdown, in a given context | 1 |
| 14 | List the post-mating (pre-zygotic) reproductive isolating mechanisms | 2 |
| 15 | Explain why hybrid inviable mechanism leads to reproductive isolation | 3 |
| 16 | Explain why hybrid sterile mechanism leads to reproductive isolation | 3 |
| 17 | Explain why hybrid breakdown leads to reproductive isolation | 3 |
| 18 | Discuss the combined impact of reproductive isolating mechanisms (pre-zygotic and post-zygotic) on speciation in populations using specific examples | 4 |

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| **Key Learning Outcome:** Students are able to demonstrate an understanding of the different patterns of evolution   * divergent evolution from a common ancestor; homologous structures * convergent evolution; analogous structures * co-evolution | | | | | | |
| **Sub-strrand 4.5 Patterns of Evolution** | Week 13  10th – 14th August | **SLO#** | **Specific Learning Outcomes:***Students are able to* | **Skill level** | **Resources** | **Assessments** |
| 1 | Define divergent evolution / convergent evolution / co-evolution | 1 | Textbook  Handout  Internet | Lesson 1: Divergent Evolution  Lesson 2: Convergent Evolution  Lesson 3: Co-evolution  Home Test 14  (15%) |
| 2 | Identify/State a feature or example of divergent evolution / co-evolution / convergent evolution, in a given context | 1 |
| 3 | Define homologous structures / analogous structures | 1 |
| 4 | Identify/State a feature or example of homologous structures / analogous structures, in a given context | 1 |
| 5 | Outline the features of divergent evolution from a common ancestor; homologous structures | 2 |
| 6 | Explain how divergent evolution from a common ancestor relates to homologous structures | 3 |
| 7 | Discuss the impact of divergent evolution from a common ancestor to the formation of new species using examples | 4 |
| 8 | Describe the features of convergent evolution; analogous structures | 2 |
| 9 | Explain how convergent evolution relates to analogous structures | 3 |
| 10 | Compare and contrast divergent and convergent evolution | 3 |
| 11 | Discuss the impact of convergent evolution from a common ancestor to formation of new species using examples | 4 |
| 12 | Describe the features of co-evolution | 2 |
| 13 | Discuss the interplay of divergent, convergent and co-evolution in the establishment of new organisms and new species | 4 |