| Version No. | | | |
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| ROLL NUMBER | | | | | | |
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| | | | | | | |

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

# BIOLOGY HSSC–II (3rd Set)

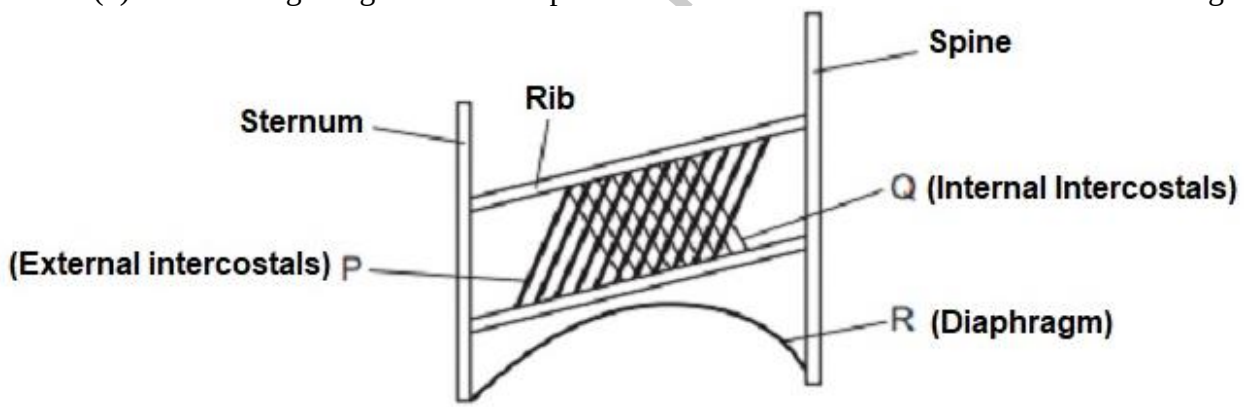
## SECTION – A (Marks 17)

**Time allowed: 25 Minutes**

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

**Q.1 Fill the relevant bubble for each part. All parts carry one mark.**

(1) The diagram given below represent some of the muscles involved with breathing.




Which muscles are contracting during inspiration?

A. P and Q ◯ B. Q and R ◯

C. P and R ◯ D. P, Q and R ◯

(2) When the outer air temperature is higher than body temperature, which of the following combination of control mechanisms is the most likely to occur?

| | constriction of blood vessels in skin | shivering | sweating | |
|---|---|---|---|---|
| A | ✓ | ✓ | ✓ | ◯ |
| B | ✓ | ✗ | ✗ | ◯ |
| C | ✗ | ✓ | ✗ | ◯ |
| D | ✗ | ✗ | ✓ | ◯ |

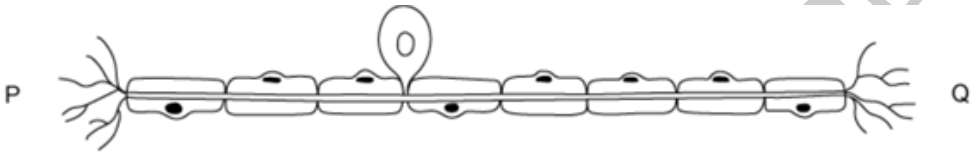
(3) The hamstring muscles are present:

A. at the back of the upper part of the leg ◯
B. at the front of the upper part of the leg ◯
C. at the back of the lower part of the leg ◯
D. at the front of the lower part of the leg ◯

(4) Maintaining a resting membrane potential across the membrane required energy from ATP. In which of the following event, the ATPs are hydrolyzed?

A. Movement of $Na^+$ ions into the neuron by $Na^+$ pump ◯
B. Movement of $Na^+$ ions out of the neuron by $Na^+$ gate ◯
C. Movement of $K^+$ ions into the neuron by $K^+$ pump ◯
D. Movement of $K^+$ ions out of the neuron by $K^+$ gate ◯

(5) The image below shows a cell from the nervous system. The cell is the part of a reflex arc.




Identify the cell shown in the diagram and if an impulse move along the cell from Q to P, what structure would be found at P and Q?

| | **cell type shown in diagram** | **P** | **Q** | |
|---|---|---|---|---|
| A. | Motor neuron | Receptor | Inter neuron | ◯ |
| B. | Sensory neuron | Inter neuron | Receptor | ◯ |
| C. | Sensory neuron | Motor neuron | Inter neuron | ◯ |
| D. | Motor neuron | Gland | Inter neuron | ◯ |

(6) Which row in the following table correctly describes what happens in the body after a person consumes a glass of sugary drink?

| | **role of the pancreas** | **role of the liver** | **effect** | |
|---|---|---|---|---|
| **A** | releases glucagon | converts glycogen into glucose | blood sugar levels rise | ◯ |
| **B** | releases insulin | converts excess glucose into glycogen | blood sugar level falls | ◯ |
| **C** | releases glucagon | converts excess glucose into glycogen | blood sugar level falls | ◯ |
| **D** | releases insulin | converts glycogen into glucose | blood sugar levels rise | ◯ |

(7) The honeybees can communicate the distance to the food source by:

1- speed of the dance
2- length of buzzing while dancing
3- a straight run

A. 1 only ◯ B. 2 only ◯
C. 1 and 2 only ◯ D. 2 and 3 only ◯

(8) Students were discussing how to remember the difference between two group of cells, “many, minute and motile” or “few, large and non-motile”. Which of the following group of cells were they referring to?

A. Animal and plant cells ◯
B. Red and white blood cells ◯
C. Xylem and phloem cells ◯
D. Male and female game cells ◯

(9) During birth following events happen:

1- Rupturing of amniotic sac
2- Contraction of myometrium
3- Cutting of umbilical cord
4- Inhibition of progesterone secretion

Which one of the following is the correct sequence of these events from start to end?

A. 1 → 2 → 3 → 4 ◯ B. 2 → 4 → 3 → 1 ◯
C. 4 → 3 → 2 → 1 ◯ D. 4 → 2 → 1 → 3 ◯

(10) If one pair of alleles exhibits complete dominance while the other pair exhibits incomplete dominance, what will be the outcome in F1 generation of a cross between **AABB** (Male) X **aabb** (female) parents?

A. all phenotypes will be similar to the male parent ◯
B. all phenotypes will be similar to the female parent ◯
C. there will be 1:1 between both parental phenotypes ◯
D. there will be 100% recombinant phenotypes ◯

(11) Albinism is a recessive trait. A normal woman with albino father and normal mother marries an albino man. What is the probability of albinism in her children?

A. Zero % ◯ B. 25% ◯
C. 50% ◯ D. 100% ◯

(12) Five different amino acids (number 1-5 below) from the following sequence is part of a polypeptide chain:

1 — 2 — 3 — 4 — 2 — 5 — 3

and mRNA codons which corresponds to these amino acids are:

1=UGU, 2=GAU, 3=CAC, 4=UAG, 5=AAG.

Which one of the following DNA base sequences could provide the code for the give section of polypeptide?

A. ACACUAGUGAUGCUAUUCGU ◯
B. ACACTAGTGATGCTAAACGTG ◯
C. ACACTAGTGATCCTATTCGTG ◯
D. CACATCUTUCTUATCTTAUTU ◯

(13) An mRNA codon for the amino acid alanine is GCC. How many alanine molecules are present in the polypeptide, containing 8 amino acids coded for by the following DNA template?

TCGGCCTACCGGGCCCATGCCAAT

A. Zero ◯ B. One ◯
C. Two ◯ D. Three ◯

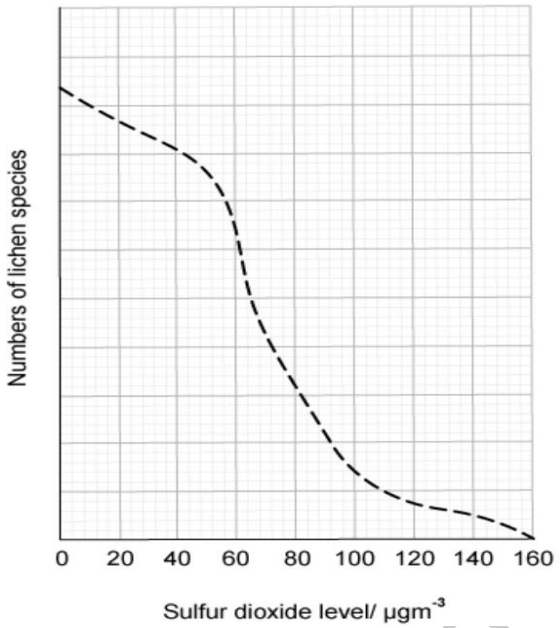
(14) When populations of a species that share the same habitat become reproductively isolated from each other and evolve into different species after many generations. Such origin of new species is called:

A. sympatric speciation ◯ B. allopatric speciation ◯
C. parapatric speciation ◯ D. natural selection ◯

(15) Which one of the following stage of sewage treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface?

A. primary ◯ B. secondary ◯
C. tertiary ◯ D. quaternary ◯

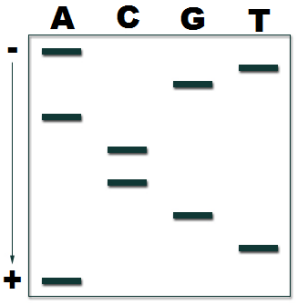
(16) The graph shows the relationship between the number of lichens and the levels of sulfur dioxide pollution. It indicates that as the sulfur dioxide levels increase, the number of lichen decreases




Which one of following is the best conclusion drawn from the above graph?

A. Sulfur dioxide is an essential nutrient for lichen growth ◯
B. Lichens are good pollution indicators ◯
C. Lichens use sulfur dioxide in photosynthesis ◯
D. Sulfur dioxide has no relation with lichen growth ◯

(17) Following is the gel pattern taken from Sangar's method of DNA sequencing. Read the sequence given in the gel:




A. 5′-ATGCCAGTA-3′ ◯ B. 5′-ATGACCGTA-3′ ◯
C. 3′-TACGGTCAT-5′ ◯ D. 3′-ATGCCAGTA-5′ ◯

Federal Board HSSC-II Examination
Biology Model Question Paper
(Curriculum 2006)

Time allowed: 2:35 hours | Total Marks: 68

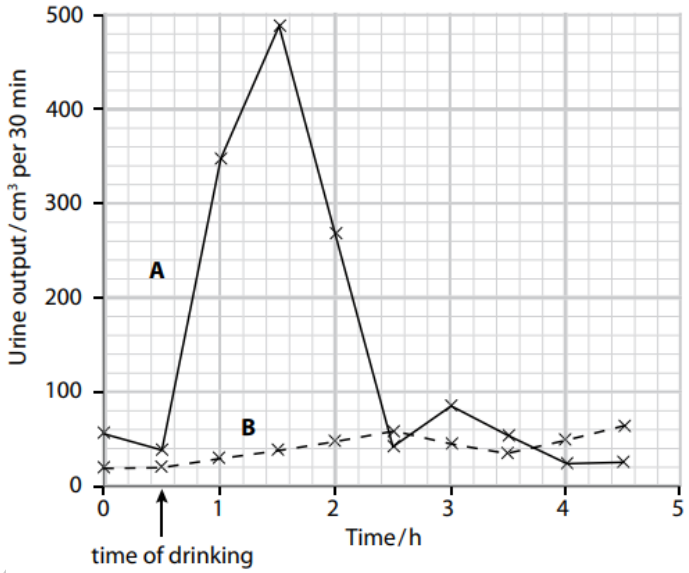
Note: Answer any fourteen parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

## SECTION – B (Marks 42)

**Q.2** Attempt any **FOURTEEN** parts from the following. All parts carry equal marks. (14× 3 = 42)

i. Cigarette smoke contains tar, nicotine and carbon monoxide. Tar is a highly toxic chemical of the smoke. How does it affect the internal structure of the lungs?

ii. In an investigation of the factors that influence urine production, a person drank one litre of water. The person's urine was collected at half-hourly intervals for four hours after drinking. The results are shown as line A on the figure. On the following day, the same person drank one litre of a dilute salt solution and the urine was collected in the same way (line B). Dilute salt solution has about the same water potential as blood plasma.

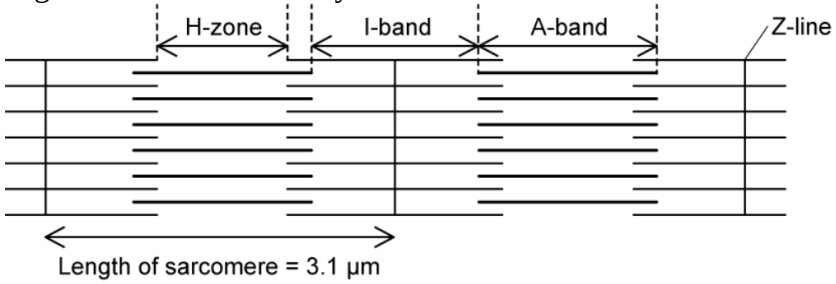



a. Calculate how much urine was produced in the two hours after drinking the litre of water. (01)

b. Suggest why the results during the second day were so different from those on the first day. (02)

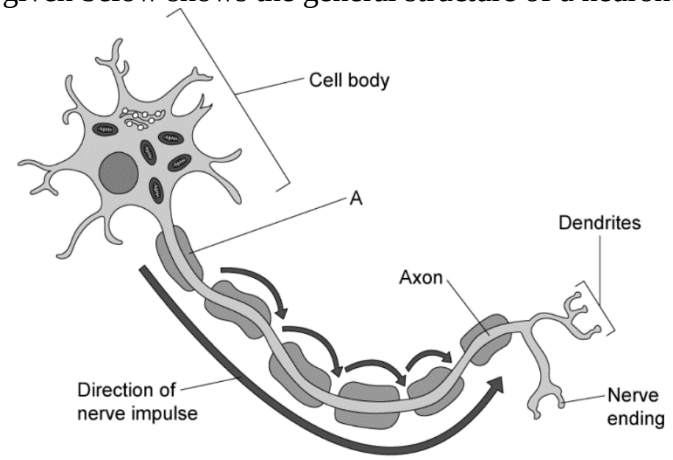
iii. In which condition kidney transplant is required? Write two characteristics of matching kidney donor which improve graft survival.

iv. The figure given below shows a myofibril strand in a relaxed muscle fiber



What will happen on the length of the A-band, I-band and H-zone, when muscle will perform contraction? (1+1+1)

v. Figure given below shows the general structure of a neuron.




Identify the structure A in the figure, give its role and explain how it influences the speed of conduction in the neuron.

vi. Identify **ONE** key factor which contributes to establishing a resting membrane potential of about -70mV and explain how this is achieved by that factor.

vii. What are the sites of secretion of progesterone during pregnancy and menstrual cycle and write its brief function in both cases.

viii. Define and give examples of hostile and helpful intraspecific interactions.

ix. Identify the structure of male and female reproductive systems and write brief function of each as one of them is solved in the given table.

| Structure | Found in | Brief function |
|---|---|---|
| Epididymis | Male reproductive system | Function in the transport and storage of the sperms. |
| Urinogenital duct | | |
| Myometrium | | |
| Leydig cells | | |

x. a. Why are neural crest cells considered as fourth germ layer of the human embryo. (1)

b. What were the two conclusions of Spemann's delayed nucleation experiments? (1+1)

xi. a. How ovulation and menstruation are regulated during pregnancy? (1)

b. List two features of reproduction which make it different from rest of the life characteristics. (2)

xii. Pure-breeding *Drosophila* with straight wings and grey bodies were crossed with pure-breeding curled-wing, ebony-bodied flies. All the offspring were straight-winged and grey-bodied. Female offspring were then test crossed with curled-wing, ebony-bodied males, giving the following results:

straight wing, grey body = 113
straight wing, ebony body = 30
curled wing, grey body = 29
curled wing, ebony body = 115

a. State the ratio of phenotypes expected in a dihybrid test cross such as above. (1)

b. Explain the discrepancy between the expected result and the results given. (1)

c. Calculate the cross over value. (1)

xiii. In human, it is known that the allele for red-green colorblindness is recessive to the allele for trichromatic vision. If both husband and wife have trichromatic vision, can have colorblind son and daughter? Justify your answer by drawing the diagram of their cross.

xiv. If you found a road accident, unfortunately, the victims have got fractures in the bones of upper limb. How will you provide first aid treatment to the victims? Give any three key measures?

xv. Write the measures that a eukaryotic cell must adopt to protect its newly born mRNA from its own phosphatases and nucleases. (1.5+1.5)

xvi. If a population of certain plants which is in Hardy-Weinberg equilibrium consists of 1000 individuals, 64% of which are dominant homozygote and 32% are heterozygotes for a particular trait. Calculate the:

a. Genotype frequency of recessive homozygotes (1)
b. Gene frequency of dominant gene and (1)
c. Gene frequency of recessive gene. (1)

xvii. What is productivity of an ecosystem? Differentiate the concept of gross primary productivity and net primary productivity. (1+2)

xviii. a. If a piece of 1 kilo base pairs of human DNA contains 10 restriction sites for an enzyme, how many fragments will be produced after complete digestion with that enzyme. (1)

b. Define palindromic sequence and draw a DNA fragment showing any two palindromic sequence and highlight them? (2)

xix. Threshold potentials in receptor cells can increase and decrease. Suggest the possible advantages of this change and define the concept of threshold stimulus.

xx. Define Integrated Disease Management and give its procedure.

## **SECTION – C** (Marks 26)

**Note:** Attempt any **TWO** questions. All questions carry equal marks. (2×13 = 26)

**Q.3** a. Compare the structure and properties of Haemoglobin and Myoglobin.Also describe their role in human body. (5)

b. Describe role of foetal and maternal hormones in parturition and explain the stages of labor process. (8)

**Q.4** a. In sweet-pea plants, the gene A/a controls flower colour. The dominant allele gives purple flowers and the recessive allele red flowers. A second gene, B/b, controls the shape of the pollen grains. The dominant allele gives elongated grains and the recessive allele spherical grains. A plant with the genotype AaBb was test-crossed by interbreeding it with a plant with red flowers and spherical pollen grains. Copy and complete the table to show the expected ratio of phenotypes of the offspring of this cross. The gametes from one parent are already in the table. (5)

| | | **Gametes of one parent** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **AB** | | **Ab** | | **aB** | | **ab** | |
| | | **Genotype** | **Phenotype** | **Genotype** | **Phenotype** | **Genotype** | **Phenotype** | **Genotype** | **Phenotype** |
| **Gamete of other parent** | | | | | | | | | |

b. Describe Meselson-Stahl experiment as an evidence of semiconservative replication of DNA.Also draw flow diagram of the experiment. (8)

**Q.5** a. Describe the mechanism of Polymerase Chain Reaction and draw its labelled diagram. (8)

b. Discuss how Darwin's theory of evolution by natural selection explains the origin of new species. (5)

* * * * *

# BIOLOGY HSSC-II (3rd Set)

**Student Learning Outcomes Alignment Chart**
**(Curriculum 2006)**

## SECTION – A

**Q.1**

(1) Describe the ventilation mechanism in human
(2) Describe the regulatory strategies in man for thermoregulation
(3) Describe the action of antagonistic muscles in the movement of knee joint.
(4) Describe the generation and transmission of nerve impulse
(5) Explain the functions of three types of neurons with the help of a reflex arc.
(6) Outline the major function of the hormones of pancreas and also relate the problems associated with imbalance of these hormones
(7) Justify the fact that each species displays its own characteristic instinctive behaviour through the example of dances of bees
(8) Explain the structures of Male and Female reproductive system and describe their functions.
(9) Describe the role of fetal and maternal hormone in initiating labor pain and culminating in the birth of a baby.
(10) Differentiate between incomplete dominance and co-dominance
(11) Evaluate the inheritance of genes and their mixing during fertilization is based on mathematical probabilities.
(12) Explain the mechanism of transcription
(13) Describe the mechanism of protein synthesis
(14) Define the concept of speciation and explain the mechanism of speciation (allopatric, parapatric and sympatric speciation)
(15) Human impacts on environment
(16) Explain the Maxam-Gilbert Method and Sanger-Coulson Methods of DNA sequencing
(17) Explain the role of microbes in household food processing, industrial production, sewage treatment and energy generation.

## SECTION – B

**Q.2**

i. List the effects of smoking on respiratory system.
ii. a, b. Justify the functioning of kidneys as both excretion and osmoregulation.
iii. Describe the principles and the problems associated with kidney transplant.
iv. Explain the sliding filaments model of muscle contraction.
v. Describe the detailed structure of a sensory neuron, associative and a motor neuron and relate the specialization in structures with functions.
Compare the velocities of nerve impulse in the axon membrane and in the synaptic cleft.
vi. Describe the generation and transmission of nerve impulse.
Name the factors responsible for the resting membrane potential of neuron.
vii. Locate the following endocrine glands in human body; pituitary, thyroid, parathyroid, pancreas, adrenal, gonads.
viii. Describe social behavior in terms of hostile and helpful interactions between animals belonging to the same species.
ix. Describe the structures of male reproductive system identifying their functions.

Explain the structures of female reproductive system and describe their functions.

x. a. Describe the formation of neural crest and list the structures that are derived from neural crest cells.

b. Through experimental narration, describe the role of the nucleus and cytoplasm in controlling development.

xi. a. Describe the menstrual cycle emphasizing the role of hormones.

b. Reproductive System of Man

xii. a,b,c. Exemplify the concept of gene linkage by quoting the example of wing length and width of abdomen in *Drosophila melanogaster*.

xiii. Critically analyze the inheritance of Haemophilia, colour blindness and muscular dystrophy.

xiv. Describe the first-aid treatment for fracture.

xv. Explain why the length of transcribed m-RNA molecule (in Eukaryotes) shortens as it enters the cytoplasm for translation

xvi. Describe the assumptions of the Hardy-Weinberg theorem and relate these to the factors that change the allelic frequencies of the population.

xvii. Describe productivity in terms of gross primary productivity and net primary productivity.

xviii. Describe productivity in terms of gross primary productivity and net primary productivity.

xix. Explain synaptic transmission of nerve impulse.

xx. Explain what is meant by integrated disease management

## SECTION – C

**Q.3** a. Describe the role of respiratory pigments.

b. Describe the role of fetal and maternal hormones in initiating labor pains and culminating in the birth of baby.

**Q.4** a. Explain the law of independent assortment, using a suitable example.

b. Narrate the work of Meselson and Stahl to justify the semi-conservative replication as the correct method of replication.

**Q.5** a. Describe the steps involved in gene amplification through polymerase chain reaction.

b. Explain the theory of natural selection as proposed by Darwin.

# BIOLOGY HSSC-II (3rd Set)

Table of Specifications

| Assessment Objectives | Unit 14: Respiration | Unit 15: Homeostasis | Unit 16: Support and Movement | Unit 17: Nervous Coordination | Unit 18: Chemical Coordination | Unit 19: Behaviour | Unit 20: Reproduction | Unit 21: Development and aging | Unit 22: Inheritance | Unit 23: Chromosome and DNA | Unit 24: Evolution | Unit 25: Man and his Environment | Unit 26: Biotechnology | Unit 27: Biology and Human Welfare | Total Marks | %age |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K (Knowledge)** | Q2(i) 3 marks | Q2(iii) 3 marks | Q1(3) 1 mark Q2(xiv) 3 marks | Q1(4) 1 mark Q2(vi) 3 marks | Q2(vii) 3 marks | Q2(viii) 3 marks | | Q2(x) 3 marks | | | Q1(14) 1 mark | Q2(xvii) 3 marks | Q2(xviii) 3 marks | Q1(17) 1 mark Q2(xx) 3 marks | 34 | 29.3% |
| **U (Understanding)** | Q3(a) 5 marks | Q1(2) 1 mark | Q2(iv) 3 marks | Q2(v) 3 marks Q2(xix) 3 marks | | Q1(7) 1 mark | Q1(8) 1 mark Q2(xi) 3 marks | Q1(9) 1 mark Q3(b) 8 marks | | Q1(13) 1 mark Q2(xv) 3 marks Q4(b) 8 marks | Q2(xvi) 3 marks Q5(b) 5 marks | | Q1(16) 1 mark Q5(a) 8 marks | | 58 | 50 % |
| **A (Application)** | Q1(1) 1 mark | Q2(ii) 3 marks | | Q1(5) 1 mark | Q1(6) 1 mark | | Q2(ix) 3 marks | | Q1(10) 1 mark Q1(11) 1 mark Q2(xii) 3 marks Q2(xiii) 3 marks Q4(a) 5 marks | Q1(12) 1 mark | | Q1(15) 1 mark | | | 24 | 20.7% |
| **Total Marks** | 9 | 7 | 7 | 11 | 4 | 4 | 7 | 12 | 13 | 13 | 9 | 4 | 12 | 4 | 116 | 100% |

**KEY:**

1(1)(1)

Question No. (Part No.) (Allocated Marks)

**Note:** (i) The policy of FBISE for knowledge based questions, understanding based questions and application based questions is approximately as follows:

a) 30% knowledge based.
b) 50% understanding based.
c) 20% application based.

(ii) The total marks specified for each unit/content in the table of specification is only related to this model question paper.

(iii) The level of difficulty of the paper is approximately as follows:

a) 40% easy
b) 40% moderate
c) 20% difficult