KENYATTA UNIVERSITY

EXAMINATION FOR THE DEGREE OF BACHELOR OF PHARMACY (Level IV)

PPD 410: PHARMACOGNOSY IV

3RD TRIMESTER 2021/2022 **TIME: 3 HOURS**

INSTRUCTIONS:

1. **This paper consists of two sections; A, B and C**
2. **Answer all questions**
3. **Answer sections A, B, C and D in separate booklets**

SECTION A: CHEMOTAXONOMY AND BIOSYNTHESIS

1. The building blocks for secondary metabolism are derived from primary metabolism. Substantiate this statement giving relevant examples (7 marks)

(a). Describe the concept of chemotaxonomy (3 marks)

(b). List four functions of secondary metabolites in plants (2 marks)

(c). Secondary metabolites are often used in the nomenclature of medicinal plants. List four examples. For each plant provide the chemical classification and the clinical uses of the key phytoconstituents (4 marks)

(d). Describe the role of chemotaxonomy in the discovery and development of novel therapeutic agents (4 marks)

2. Outline the metabolic steps in;

(a). the synthesis of shikimic acid (5 marks)

(b). the synthesis of aromatic amino acids from chorismic acid (5 marks)

3.

(a). Explain four properties of enzymes that enable them to catalyse the synthesis of secondary metabolites (2 marks)

(b). Giving examples, explain how the control of enzymatic processes can influence the yield in secondary metabolites in plants (4 marks)

(c). Describe how abiotic stresses can influence the synthesis of secondary metabolites in medicinal plants (4 marks)

SECTION B: BIOTECHNOLOGY

1. Define the following terms: (5 marks)
   (a). Autotrophy
   (b). Callus
   (c). Explant
   (d). Protoplast
   (e). Primary metabolites

2. Answer TRUE of FALSE (5 marks)
   (a). Organic carbon is supplied by adding glucose to culture medium.
   (b). Agarose contains agropectin sulphate groups
   (c). Bubble column reactors damage hairy roots due to high shear stress.
   (d). Stirred cultures are mixed using aeration and magnetic stirrers.
   (e). Continuous cultures are maintained in exponential state
   (f). In turbidostat culture, steady state condition the density, growth rate, chemical composition and metabolic activity of the cells remain constant.
   (g). Mechanical protoplast removal is the most efficient and maintains cell viability
   (h). Gellan gums consist of a polysaccharide produced by red algae
   (i). Molybdenum deficiency inhibits cell division and elongation in both root tip and shoot tip meristems
   (j). Calcium hypochlorite is less injurious to plant tissues than sodium hypochlorite

3. Explain four factors affecting tissue culture (4 marks)
4. Outline the cell wall formation test. (4 marks)
5. List four properties of hairy roots that make them suitable for secondary metabolite production (4 marks)
6. Using Artemisinin as an example, explain how synthetic biology can be used to improve the production of natural product drugs that are currently extracted directly from the producing organism. (8 marks)
7. A certain gene *X* increases the yield of a secondary metabolite, Y, in a plant. Secondary metabolite Y induces resistance to *Arabidopsis thaliana*. You have been tasked to generate genetically modified plants carrying gene X. Assuming that the plant cells can be easily transformed and plants generated from plant tissue culture:

(a). Outline the steps involved in the introduction of the gene into the plant cells (3 marks)

(b). Describe how you would test the transformed cells for desired; (3 marks)

i. Genotype

ii. Phenotype

(c) Discuss two ways how you would maximize the yield of secondary metabolites. (4 marks)

SECTION C: PLANT DRUGS OF ABUSE AND TOXIC PLANTS

1. (a) Explain the concept of toxicity testing of medicinal plant (3 marks)
   (b) Describe the methods of toxicity testing of medicinal plants in pre-clinical settings (7 marks)
2. Claviceps purpurea is a well-known potential poisonous contaminant in grains;
   (a) Explain preventive measures that can be taken to minimise risk of poisoning (2 marks)
   (b) Describe the signs, symptoms and management in a cute poisoning (4 marks)
   (c) Identify two phytoactive compounds of this fungus and their clinical uses (2 marks)
   (d) Name two other fungi associate with contamination of grains (2 marks)
3. With regard to psychedelic mushrooms
   (a) Explain two reasons for their popularity as recreational drugs (2 marks)
   (b) Describe their traditional uses in Africa (2 marks)
   (c) Name two common species and the main phytoconstituents in each (2 marks)
   (d) Describe mechanism of activity of the name phytoconstituents (2 marks)
   (e) Explain the clinical manifestations in acute poisoning (2 marks)
4. Giving relevant examples, discuss how the phytoconstituents of known toxin plants have found clinical application (10 marks)