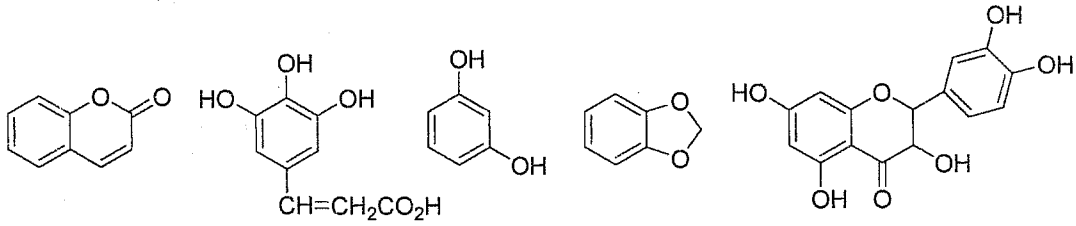
THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2015/2016
LEVEL 5-FINAL EXAMINATION
CHU 3131/CHE 5131
THE CHEMISTRY OF AMINO ACIDS, SUGARS AND RELATED COMPOUNDS

DURATION: 2 HOURS

Tuesday, 24th January 2017 9.30 a.m. - 11.30 a.m.

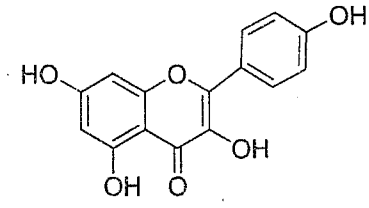
Answer any FOUR questions only.
If you have answered more than four questions, only the first four answers will be marked.

1. (a) The following phenolic compounds are formed by different biosynthetic pathways. Identify the possible biosynthetic pathway of each of them.



(25 Marks)

(b) Kaemperol (**F**) is a natural flavonol which acts as an antioxidant. UV absorption spectra of an ethanolic solution of **F** show a band in 250-270 nm region.



(i) Explain the effect of addition of the following to the solution on its UV absortion spectrum.

I. Sodium acetate II. Aluminium chloride

(40 Marks)

(ii) Compare the acidities of the OH groups at C-5 and C-7 giving reasons.

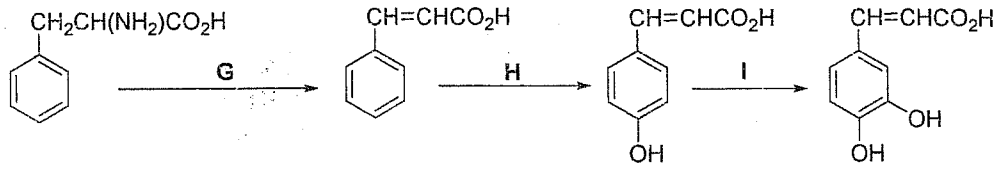
(15 Marks)

(iii) Write the reaction for the reduction of kaempferol using methanolic HCl and Mg.

(20 marks)

2. (a) Phenylalanine can be converted to phenolics and related compounds.

(i) Given below is the conversion of phenylalanine into caffeic acid. Identify the processes labeled as **G**, **H** and **I**.



phenylalanine — cinnamic acid — p-coumaric acid — caffeic acid

(15 marks)

(ii) Give the structure of the compound formed when caffeic acid undergoes o-methylation.

(10 marks)

(b) Show the possible biosynthetic pathway of C_6-polyketide formation from acetyl coenzyme A (CH_3CO-SCoA) when labeled CO_2 ($^{14}CO_2$) is introduced to the plant.

(30 marks)

(c) Tannins are a class of polyphenols that occur in plants.

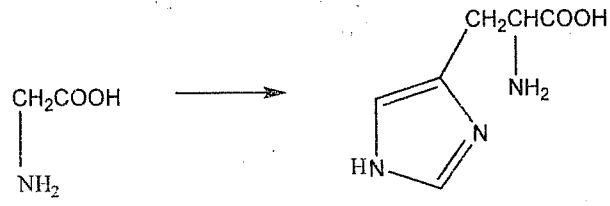
(i) Give three beneficial effects of tannins.

(30 marks)

(ii) How does dietary tannins effect proteins?

(15 marks)

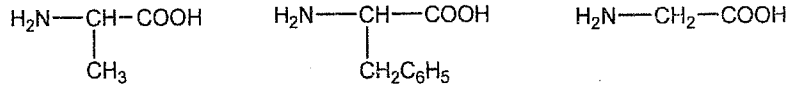
3.(a) How would you effect the following transformation? Give the necessary reagents write the mechanism for the reaction.



glycine — histidine

(30 marks)

(b) (i) Write the structure of the pentapeptide Ala.Gly.Ala.Phe.Gly.

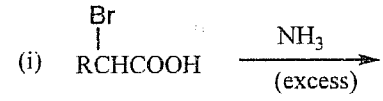


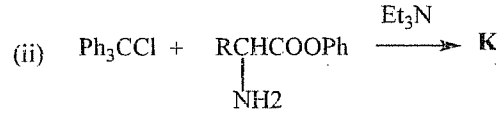
Alanine — Phenylalanine — Glycine

(ii) Give the structural formulae of the products obtained when the pentapeptide is reacted with 2,4-dinitroflurobenzene followed by acid hydrolysis.

(40 marks)

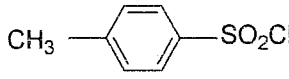
(c) Predict the products of the following reactions.

(i) 

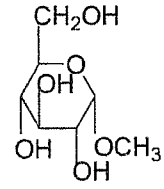
(ii) 

(30 marks)

4. (a) Draw the structures of the major product when methyl α-D-glucopyranose is treated with,

(i)  , pyridine, 0°C

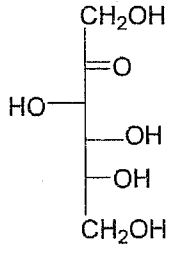
(ii) $PhCH_2Br/NaH$, DMF



methyl-α-D-glucopyranose

(30 marks)

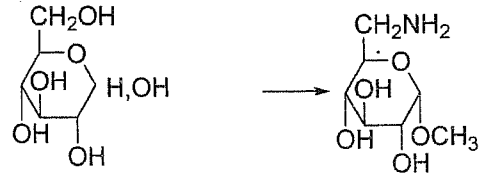
(b) Draw the Harworth projections of the anomers of D-fructofuranose.



D- fructose

(15 marks)

(c) How would you effect the following conversion?

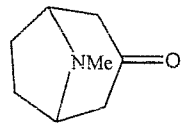


(30 Marks)

(d) Write down the Fischer projection formula of all the D-hexoses having the structural formula, $OHC(CHOH)_4CH_2OH$. Which of these on oxidation with nitric acid give optically inactive dicarboxylic acids? Explain briefly your answer.

(25 Marks)

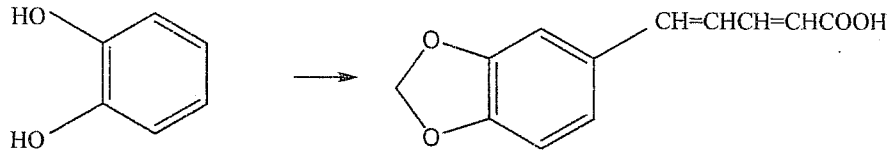
5. (a) Devise a simple synthesis of tropinone. Give the mechanism at each step.



Tropinone

(40 Marks)

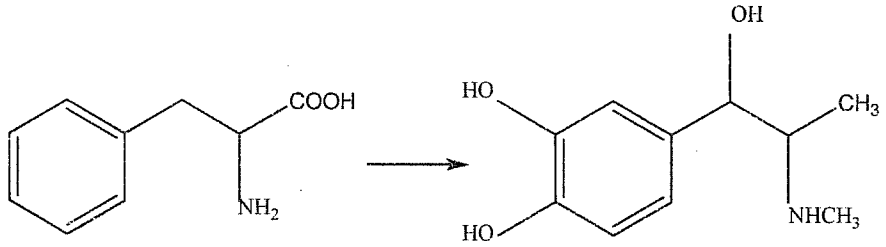
(b) Outline the synthesis of piperric acid starting from catechol.



catechol piperric acid

(30 Marks)

(c) Postulate the biosynthetic pathway leading to dopamine from phenylalanine.



Phenylalanine dopamine

(30 Marks)

6. (a) (a) Deduce the structure of the disaccharide, the common table sugar isolated mainly from sugar cane and beet, from the following. Explain each observation.

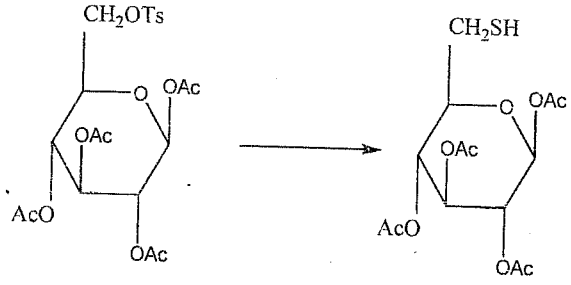
(i) It does not reduce Fehling's reagent and does not mutarotate.

(ii) It is hydrolyzed by maltase, or emulsin to D-glucose and D-fructose.

(iii) Methylation followed by hydrolysis gives 2,3,4,6-tetra-O-methyl-D-glucopyranose and a tetra-O-methyl-D-fructofuranose.

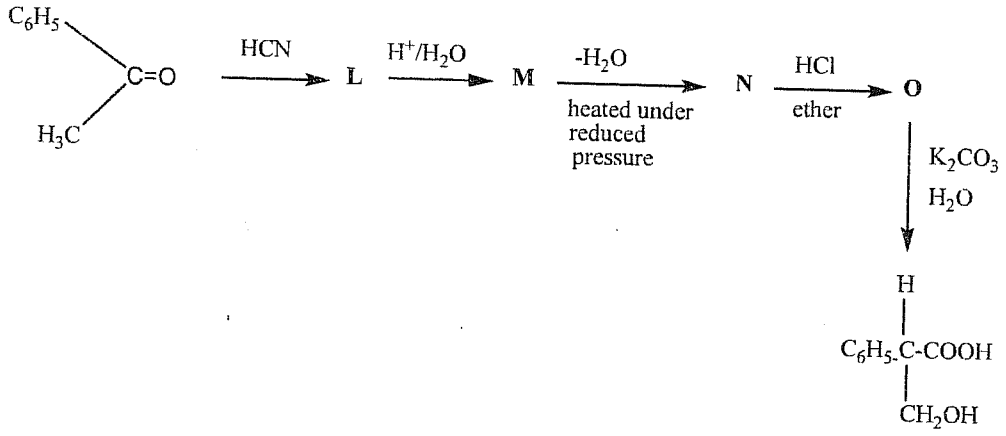
(40 Marks)

(b) How would you effect the following conversion?



(30 marks)

(c) Reactions involved in the synthesis of tropic acid are given below. Identify the compounds **L-O** in the reaction scheme.



tropic acid

(30 marks)