THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2011/2012

LEVEL 5-FINAL EXAMINATION

CHU 3131/CHE 5131
THE CHEMISTRY OF AMINO ACIDS, SUGARS AND RELATED COMPOUNDS

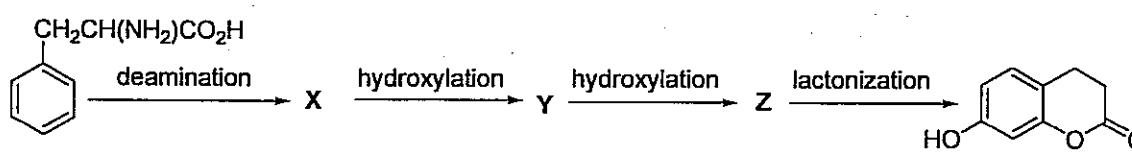
DURATION: 2 HOURS

Thursday 29th November 2012 9.30a.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) A biosynthetic route for a coumarin from phenylalanine through cinnamic acid derivatives is given below. Give the structures of the missing intermediates **X - Z.**



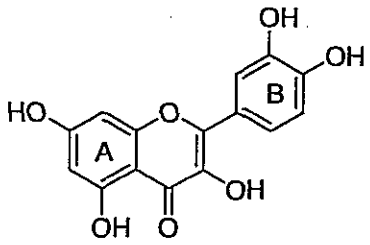
(30 marks)

(b) Tannins can be subdivided into two groups. Name the two groups and tabulate the structural properties of them as given below.

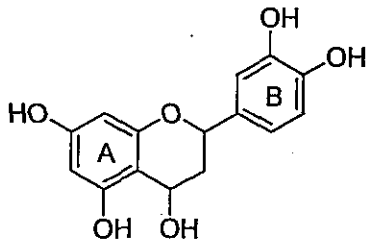
	Group	Building blocks	Type of linkage between building blocks
1.			
2.			

(30 marks)

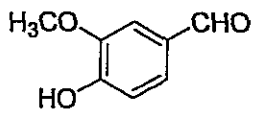
(c) Consider a mixture of two flavonoids, quercetin and catechin.



quercetin



catechin



vanillin

i. Identify the biosynthetic pathways of deriving rings A and B of the flavonoids.

ii. Classify the two flavonoids into classes according to the C_3 connecting group.

iii. A paper chromatogram of the mixture on spraying with vanillin sulphuric acid spray reagent gave a single red spot. Giving relevant chemical reactions explain the reason for this observation.

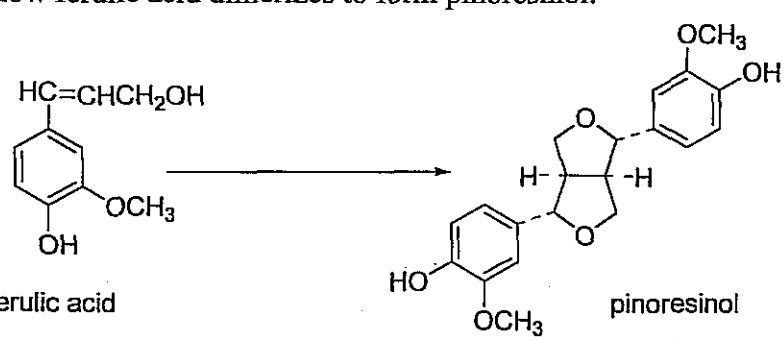
iv. UV absorption spectra of quercetin in ethanol showed strong bathochromic shifts after addition of $AlCl_3$. Explain why.

(40 marks)

2. (a) List four industrial applications of lignin.

(20 marks)

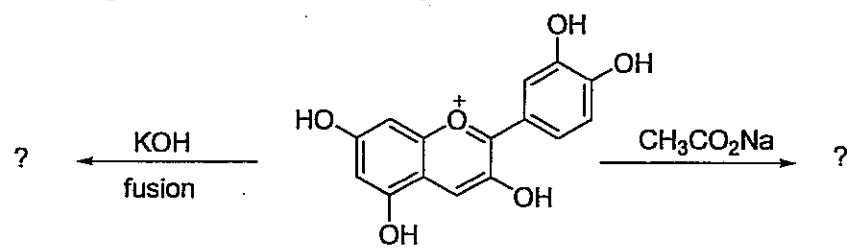
(b) Show how ferulic acid dimerizes to form pinoresinol.



ferulic acid pinoresinol

(40 marks)

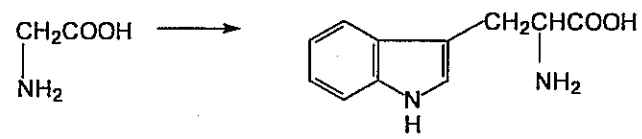
(c) Predict the products of the following reactions.



(40 marks)

3.

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



glycine tryptophan (30 marks)

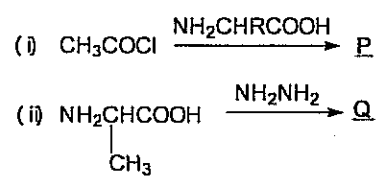
(b). (i) Give the structural formula of the tripeptide Ala.Gly.Phe.

Ala = $H_2NCHCOOH$ (CH$_3$) Gly = H_2NCH_2COOH Phe = $H_2NCHCOOH$ ($CH_2C_6H_5$)

(ii) Give the reaction product with the peptide chain Ala.Gly.Phe. of 2,4-Dinitroflurobenzene. How is this reaction used to identify the N-terminal amino acid of the peptide chain?

(40 marks)

(c) Predict the products of the following reactions.

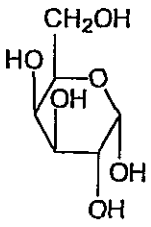


(30 marks)

4. (a) Draw the structures of the major product when methyl α-D-galactopyranose (**I**) is treated with

(i) acetone, anhy. $CuSO_4$/Conc. H_2SO_4

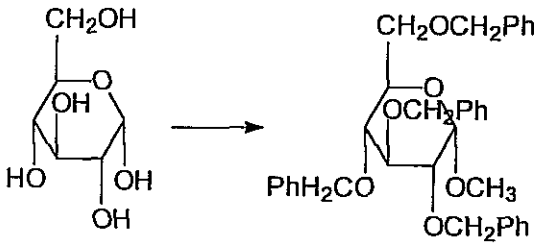
(ii) $(CH_3CO)_2O$/Pyridine, 120°C



α-D-galactopyranose (I)

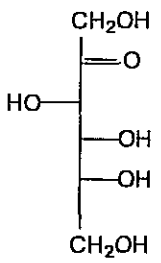
(30 marks)

(b) How would you effect the following conversion?



(25 marks)

(c) Draw the Haworth projections of the anomer of D-fructofuranose.



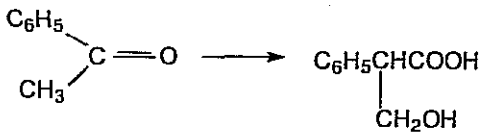
D-fructose

(15 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.

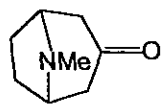
(30 marks)

5. (a) How would you effect the following transformation?



(30 marks)

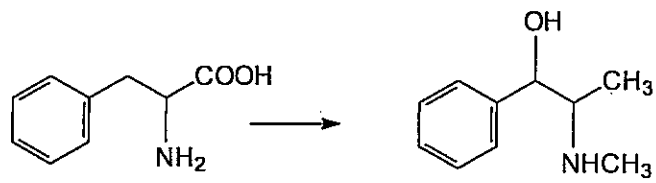
(b) (i)Devise a simple synthesis of tropinone. Give the mechanism at each step.



Tropinone

(40 Marks)

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



Phenylalanine ephedrine

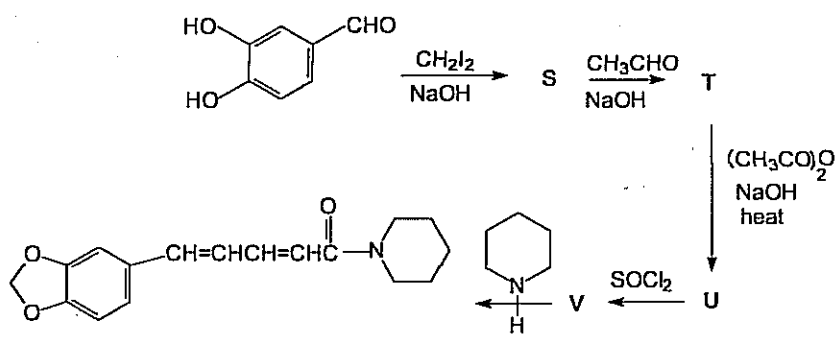
(30 marks)

6.

(a) Gentiobiose ($C_{12}H_{22}O_{11}$) undergoes mutarotation and is hydrolysed by β-glycosidase to D-glucose. Methylation followed by hydrolysis yields 2,3,4.6-tetra-O-methyl-D-glucopyranose and 2,3,4-tri-O-methyl-D-glucopyranose. Deduce the structure of gentiobiose.

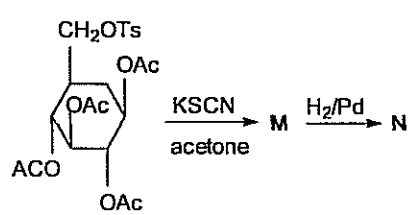
(40 Marks)

(b) Reactions involved in the synthesis of piperine are given below. Identify the compounds **S-V** in the following reaction scheme.



(40 marks)

(c) Give the structures of compound **M** and **N** in the following reactions.



(20 marks)