FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF POLYMER AND TEXTILE ENGINEERING
2014/2015 HARMATTAN SEMESTER EXAMINATION
PTE 507: ENGINEERING TECHNOLOGY OF ELASTOMERS
TIME: 2½HRS DATE: 6TH MAY, 2015

INSTRUCTION: ANSWER ANY FIVE QUESTIONS

1(a) What are the properties of an ideal rubber?
(b) Highlight on the set-backs of the theory of an ideal rubber.
(c) State the theories used in explaining rubber elasticity. Describe one of the theories.

2(a) Using the first law of thermodynamics, show how the change in internal energy (dE) varies with entropy given that Hehnholtz free energy (dA) = fdl. Give graphical illustrations to support your claim.

3(a) With the help of graphical illustrations, discuss the mechanical behaviour of vulcanized and unvulcanized rubber materials.
(b) Compute the work done at room temperature (25°C) on a rubber material of density $9.6gcm^{-3}$ stretched up to twice its original length. Take universal gas constant as $8.314Jmol^{-1}k^{-1}$. Give your answer in terms of length (x).

4(a) Describe briefly how natural rubber latex can be processed into dry rubber product.
(b) Write down three functions of each of the following additives in rubber compounding: (i) Peptising agents (ii) Plasticizers
(c) Mention and describe the various grades of natural rubber.

5(a)(i) What are fillers as used in natural rubber processing?
(ii) Give four examples each of black fillers and non-black fillers.
(b) Using free radical mechanisms, illustrate the thermal oxidative degradation of rubber by a named antioxidant.
(c) How can the number of sulphur atoms be reduced in sulphur vulcanization of rubber?

6(a) Define the expression, "Rubber Vulcanization".
(b) Give in outline (i) three (3) benefits of rubber vulcanization, and (ii) the various classes of vulcanizing agents.
(c) With the help of appropriate chemical structures, describe how silicon rubber **OR** polychloroprene can be suitably vulcanized.