corrected

INDIAN RUBBER INSTITUTE
PGDIRI EXAMINATION – 2018

Paper – III

Date : 15th July, 2018 **Time : 10.00 – 13.00 hrs.**
Duration : 3 Hours **Full Marks : 100**

Rubber Materials

Answers should be illustrated with sketches wherever helpful
Total **FIVE** questions are to be answered. **Question number 1** is compulsory. Answer **four** from the remaining questions taking **two** from each group

GROUP – A

1. Multiple choice questions: select the correct answer from the given alternatives:

(i) Pine tar acts as a:
(a) Plasticizer (b) Retarder (c) Accelerator (d) Peptizer

(ii) For tyre curing bag the most suitable rubber is
(a) CR (b) NBR (c) SBR (d) IIR

(iii) Select a cure system for best flex life of cured product:
(a) Semi EV (b) EV (c) Peroxides (d) Conventional

(iv) Which of the following polymers possesses the highest resistance to Ethyl Alcohol?
(a) HNBR (b) NBR (c) CR (d) EPDM

(v) A 100% hydrogenated NBR can be vulcanized by
(a) Sulphur and accelerator (b) Metal oxides
(c) Peroxdies (d) None of the above

(vi) Polymer suffers from cold flow
(a) CR (b) NR (c) SBR (d) NBR

(vii) Gutta-percha has the structure:
(a) 1:4 Cis polyisoprene (b) 1,4 trans polyisoprene
(c) 1:2 and 3:4 Poly isoprene (d) None of the above

(viii) The accelerator which can be used as curing agent without elemental sulfur
(a) MBT (b) CBS (c) TMTD (d) MOZ

(ix) Carbon black having the lowest BET surface area is:
(a) N110 (b) N219 (c) N339 (d) N990

(x) Acrylonitrile (ACN) content of most common grades of NBR is
(a) 10% (b) 33% (c) 67% (d) 45%

(xi) The term VGC is associated with:
(a) Carbon black (b) Rubber processing oil (c) ZnO (d) Natural Rubber

(xii) Which carbon black gives the best compression set resistance?
(a) HAF (b) ISAF (c) SRF (d) MT

(xiii) Which polymer accepts maximum loadings of filler and oil?
(a) EPDM (b) Silicone (c) PU (d) SBR

(xiv) Pentachloro thiophenol is used in NR compounds to:
(a) Improve OCT (b) Decrease MV (c) Improve ageing properties (d) None of them

(xv) In textiles, the term "denier" is an indication of:
(a) Strength of the fiber (b) Gauge of the fabric
(c) Twist of the cord (d) Modulus of the yarn

(xvi) Which of these thermoplastics elastomers has the best oil resistance?
(a) TPO (b) TPU (c) SEBS (d) SBS

(xvii) The ASTM series number for cold SBR gum rubber is:
(a) 1000 (b) 1500 (c) 1700 (d) 2000

(xviii) Which filler you should select for acid resistant tank lining?
(a) $CaCO_3$ (b) ZnO (c) $BaSO_4$ (d) $Al_2O_3,3H_2O$

(xix) What is the weight percent of chlorine in PVC?
(a) 16% (b) 36% (c) 46% (d) 56%

(xx) The best resilience is shown by
(a) SBR (b) IIR (c) BR (d) NBR

(1 x 20) = 20

2. (a) What is the particle size of latex? How VFA of Natural rubber latex is measured?
(b) What is the significance of the plasticity retention index (PRI) test?
(c) Explain with examples the significance of using CV and EV systems of curing in NR compounds.
(d) Write down the composition of natural rubber latex? Why it is necessary to concentrate natural rubber latex?

(4+4+ 6+2x3) = 20

3. (a) Which polymers you will select for cable insulation in case of power cables intended for use in the following voltage range. Explain with reasons for your choice?
(i) Up to 1 KVA (ii) Up to 11 KVA (iii) Up to 33 KVA (iv) Up to 300 KVA
(b) Select most appropriate polymer/polymer blends and filler for each of the following applications with proper reasoning.
(i) White sport shoe sole (ii) Hard Battery boxes (iii) Engine mountings
(iv) Radiator hose (v) Tank lining for sulfuric acid
(v) Tread compound with good skid resistance Truck tyre

(4 x 2+ 6 x 2) = 20

4. (a) What are Thermoplastic Elastomers and How are they different from thermoset Ealstomers?
   (b) Mention different types of thermoplastic elastomers available showing the structural formulate and their main applications?
   (c) What is the different between TPEs and TPVs

(6+10+4) = 20

GROUP- B

5. (a) Name a few non-black filler and arrange them in order of their reinforcing ability?
   (b) How following characteristics of a filler when added will affect processing behavior and vulcanized properties of a rubber compound.
   (i) Particle size, (iii) Structure, (iii) Surface characteristics, (iv) pH., (v) Surface area
   (c) What is the ASTM Nomenclature of N-219 stands for?
   (d) Discuss about the versatile uses of zinc oxide in rubber compounds.

(4+10+2+4) = 20

6. Explain with proper reason of the following (Any five)
   a) Natural rubber needs to be masticated whereas no mastication is required for SBE, NBR - Why?
   (b) The most preferred polymer for microwave cured profile for car is EPDM although it is not a polar polymer - Why?
   (c) Peroxide curing system can not be suitable for the curing of butyl rubber- Why?
   (d) In bridge bearing pad polychloroprene rubber is widely used – Why?
   (e) In XLPE cable EVA is a preferred polymer in conductor and semi conductor compound – Why?
   (f) In ~~NRB~~ NBR based compound higher dosage of SRF type and oil is used to improve volume swell in mineral oil-Why?

(5x4) = 20

7. (a) Just mention the function of each of the following ingredients in rubber compounds :
   (i) ethylene thiourea, (ii) ZMBT, (iii) p-nitroso benzene,
   (iv) DOP, (v) zinc oleate, (vi) mercapto silane,
   (vii) azodicarbonamide, (viii) antimony trioxide, and (ix) resorcinol.
   (b) Define the terms: Linear density, tenacity as applied in textile technology.
   (c) Calculate the tenacity and linear density of a yarn when 500 cm of that yarn weighs 5 ~~gms~~ and its breaking load is 10 ~~gms~~.
   (d) Which textile cord materials are preferably used in the following products?
   (i) V-belt (ii) Belt in radial tyre (iii) Truck tyre carcass (iv) Radial tyre carcass

(10+4+4+2) = 20

8. Write short notes on **any four** of the following:
   (a) Advantage & disadvantage of peroxide curing.
   (b) Plasticizers and softeners
   (c) Fluorocarbon Rubbers
   (d) Insoluble sulpher
   (e) Retarders
   (f) RFL dip on textile

(4 x 5) = 20