

INDIAN RUBBER INSTITUTE

PGD-IRI EXAMINATION – 2017

Paper - III

Date : 20.08.2017

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. Each question carries 20 marks

Part A : **Question No. 1** is compulsory and answers **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) Polymer used in insulation of household cable is:
(a) FKM (b) EPDM (c) Plasticized PVC (d) NR
- (ii) Which rubber has the widest temperature range of application?
(a) Poly Sulphide (b) EPDM
(c) Chlorosulphonated Poly ethylene (CSPE) (d) Silicone
- (iii) Paraffin mineral oil is the most compatible with
(a) Butyl rubber (b) Polychloroprene rubber
(c) Natural rubber (d) Nitrile rubber
- (iv) Polymer which shows the best gum strength
(a) SBR (b) BR (c) NBR (d) NR
- (v) PF Resin curing is the most suitable for
(a) NR (b) BR (c) IIR (d) NBR
- (vi) Peroxide curing is not technically recommended for :
(a) NR (b) IIR (c) NBR (d) CR
- (vii) To improve the conductivity of the compound which carbon black is preferred?
(a) GPF (b) Vulcan XC72 (c) SRF (d) FEF
- (viii) Chemicals used as a stabilizer for NR latex
(a) Formic acid (b) Ammonia (c) Hydrochloric acid (d) Calcium carbonate
- (ix) Colloidal dispersion of sulfur is used as a curative for
(a) Tyre (b) Metal-rubber bonding (c) Latex product (d) Tank lining

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- (x) Best combination of oil and heat resistance is shown by
(a) VMQ (b) CR (c) EPDM (d) HNBR
- (xi) The most widely used textile reinforcement of V-belt is
(a) Polyester (b) Aramid (c) Glass (d) Nylon
- (xii) Which filler you should select for acid resistant tank lining?
(a) CaCO_3 (b) ZnO (c) BaSO_4 (d) $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$
- (xiii) Dinitroso pentamethylene tetramine is used in rubber compounds to:
(a) Retarder (b) Antiozonant (c) Blowing agent (d) Dispersing agent
- (xiv) 100% NR should be used for
(a) Cycle Tyre (b) Car Tyre (c) Solid Tyre (d) Aero Tyre
- (xv) Suitable polymer blend for manufacturing Rice Dehusking Rollers is:
(a) NR/SBR (b) NBR/PVC (c) NBR/PF (d) NR/HSR
- (xvi) Which polymer suffers from 'cold flow'?
(a) NR (b) CR (c) IIR (d) NBR
- (xvii) Which polymer accepts the maximum loadings of filler and oil?
(a) BR (b) Silicone (c) PU (d) SBR
- (xviii) Neoprene AC has a trans content of:
(a) 70% (b) 90% (c) 100% (d) 80%
- (xix) Rubber hot water bottle is made from:
(a) IIR (b) Silicone (c) CPE (d) NR
- (xx) Suitable polymer blend for manufacturing Rice Dehusking Rollers:
(a) NR/SBR (b) NBR/PVC (c) NBR/PF (d) NR/HSR
- (1 x 20) = 20
- 2.a) Starting from field latex, describe how technically specified grades of Natural Rubber (ISNR or SMR) are produced.
- b) Explain how the RSS and TSR are graded?
- c) What are the advantages of technically specified grades over conventional grades?
- d) Explain why green strength of NR is higher than synthetic Polyisoprene.
- 8+3+5+4 = 20
- 3.a) What are the limitations of butyl rubber?
- b) Describe briefly the manufacture process of butyl rubber.

- c) What are the curing systems used for butyl rubber? Name each product where such system is preferred.
- d) What are the basic differences between random and block copolymer?
- e) Discuss one of the methods of production of reclaimed butyl rubber from scrap rubber with its major applications

2+7+4+3+4 = 20

4. a) Describe the grading system used for rubber grade carbon blacks.
- b) Write briefly the manufacturing process of furnace carbon black.
- c) What is meant by 'Surface area' and 'Structure' of carbon blacks?
- d) What are the differences between N110 and N660 as far as reinforcing properties are concerned?
- e) What is the special about conductive carbon blacks?

5+6+4+3+2 = 20

- 5.a) Select suitable polymer/blend, curative, plasticizer and filler for following application. Justify your choice each ingredient briefly.
- i) Rubber vulcanizates with following properties good TS³ 25 MPa, EB³ 450% with good fatigue resistance.
- ii) Metal bonded oil seal with good mechanical properties.
- b) What type of curing system is recommended for the following rubbers/blend
- i) EVA
- ii) Fluorocarbon rubber
- iii) 70/30 NBR/PVC blend
- iv) Bromobutyl rubber
- c) Name the type of accelerator, vulcanizing agents and filler used in curing the following rubber products.
- i) NR based conveyor compound
- ii) EVA based conductive layer of XLPE cable
- iii) Cycle tyre tread compound
- d) Give **One/Two** examples of each of the following.
- i) Retarders
- ii) Peptizers
- iii) Antioxidants

5 x 2+(1x4)+3+3 = 20

- 6.a) Compare and contrast NBR and CR? What grade of CR is used for stuck on process adhesive for shoe and why?
- b) Outline the different technologies of recycling of tires. Compare the different recycle materials produced out of these technologies.
- c) Which polymers you will select for cable insulations 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) 11 KVA to 33 KVA and iii) Up to 300 KVA

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

- 7.a) Mention the most suitable elastomer(s) for each of the following, and give reasons why.
- i) Tyre tread compound with good skid resistance.
- ii) Rubberized roll in the paper industry.

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- iii) Engine mountings.
- iv) Cable sheath.
- v) Bride bearing pad.
- b) Write down a typical recipe for any one of the above items, justifying your choice in ingredients.
- c) What is Aniline point? How the value of Aniline point helps to assess the type of quality of a plasticizer?

2 x 5+6+4 = 20

8. Write short notes on (Any Five) :

- a) Mastication of natural rubber
- b) Comparison of Nylon 6 and Nylon 66
- c) Reinforcing white fillers
- d) Microstructure and properties of solution and emulsion SBR
- e) Tackifiers
- f) Flame retardants and smoke depressant
- g) Plastisizer and softners

4 x 5 = 20