

INDIAN RUBBER INSTITUTE

DIRI EXAMINATION – 2017

Paper - IV

Date : 20.08.2017

Time : 14.00-17.00 hrs.

Duration : 3 Hours

Full Marks : 100

RUBBER PRODUCT MANUFACTURING AND THEIR EVALUATION

Answers should be illustrated with sketches wherever helpful

Question number 1 is compulsory. Answer **Four** from the remaining questions taking **Two** from each group

GROUP – A

- 1.(a) Select the right answers from the given alternatives.
- (i) Which is very specific operation in hose manufacturing?
(a) Frictioning (b) Dipping (c) Splicing (d) Braiding
- (ii) Which of the following operation is associated with conveyor belt manufacturing.
(a) Calendering (b) Extrusion (c) Dipping (d) Braiding
- (iii) Lug and Semi lug these two terms are associated with following products.
(a) Rubber boat (b) Truck tyre (c) Mining Conveyor belt (d) Marine hose
- (iv) The term Aspect Ratio is relevant for
(a) Conveyor belt (b) Cable (c) Tyre (d) Hose
- (v) Textile to rubber peel adhesion test is carried out at traverse speed of
(a) 100 mm/min (b) 200 mm/min (c) 300 mm/min (d) 400 mm/min
- (vi) Drum friction test is the test associated with
(a) Conveyor belt (b) V-belts (c) Tyre (d) Cable
- (vii) Which gelling agent is used for production of latex foam by Dunlop process?
(a) Acetic acid (b) Potassium oleate (c) Calcium chloride (d) Sodium silicofluoride
- (viii) Corana resistance should be measured for:
(a) Tyre (b) Hose (c) V-belt (d) Cable
- (ix) In a Braided Hose, if the braid angle is less than the neutral angle, the hose will:
(a) Fatigue (b) Stress relaxation (c) Creep (d) Set
- (x) Holography is the test to evaluate:
(a) Shoe (b) Hose (c) V-belt (d) Tyre

[TURN OVER]

- 4.(a) Mention the appropriate units of the following properties
- (i) Volume resistivity
 - (ii) Tear strength
 - (iii) Tensile modulus
 - (iv) Density of textile yarn
 - (v) Flex cracking resistance
- (b) Explain the following terms of rubber properties
- (i) Stiffness (ii) Creep (iii) Stress relaxation (iv) Tear resistance
- (c) What is mean by dispersion Index of fillers? Why it is important for Rubber Product manufacturing unit?

$$5 + (4 \times 2) + 7 = 20$$

GROUP – B

- 5.(a) Write briefly how the Rebound Resilience and Heat build-up of rubber compounds are measured.
- (b) The striker of Dunlop tripsometer is dropped from an angle of 45° and after impact with the rubber specimen returned through an angle of 30° . Calculate the rebound resilience of rubber. (Value of $\cos 45^\circ$ and $\cos 30^\circ$ are 0.866 and 0.707.
- (c) How both the properties, Rebound Resilience and Heat build-up influence the performance of Truck tyre tread?

$$7 + 6 + 7 = 20$$

6. (a) Discuss the important of "conditioning" of test pieces while testing.
- (b) Mention important processing care to be taken during calendaring and extrusion process.
- (c) Name a few important properties often used to check the quality of rubber vulcanizate and mention instruments used to measure these properties.
- (b) Write the **Full form** of the followings :

- (i) ISO
- (ii) ASTM
- (iii) PRI
- (iv) ISAF
- (v) DRC
- (vi) SMR
- (vii) IRHD
- (viii) RMA

$$4 \times 3 + 8 = 20$$

7. (a) What are the different fatigue tests that are generally carried out for rubber products.
- (b) What is meant by Abrasion Resistance Index?
- (c) Write briefly how the Abrasion Resistance of Rubber compound is measured.
- (d) Draw standard curves you get from Mooney viscometer and Rheometer.
- (e) What is the purpose of using a Mooney viscometer and Rheometer?

$$5 + 4 + 5 + 3 + 3 = 20$$

[TURN OVER]

- (xi) Flex cracking resistance of shoes soles is tested by:
(a) Goodrich flexometer (b) De Mattia flexometer
(c) Ross flexometer (d) Stress relaxometer
- (xii) Which property does not relate to stiffness of the vulcanizate?
(a) Young's modulus (b) M-300% (c) Hardness (d) Tensile strength
- (xiii) The best curing system for metal-rubber bonding should be based on:
(a) EV (b) Conventional (c) peroxide (d) Semi-EV
- (xiv) Dry Bonding Agent is used to enhance:
(a) Metal to Rubber Bonding (b) Metal to Plastic Binding
(c) Fabric to Rubber Bonding (d) Fabric to Plastic bonding
- (xv) NBR is blended with PVC to improve:
(a) Tensile strength & tear strength (b) Heat resistance & oil resistance
(c) Ozone resistance & flame resistance (d) Air impermeability and damping

1 x 15 = 15

- (b) State if the following statements are TRUE or FALSE.
- (i) Abrasion resistance improves when polybutadiene is blended with natural rubber.
(ii) Dirt content of RMA-1 grade of natural rubber is higher than RMA-4 grade.
(iii) For tubeless tyre air is retained by side wall.
(iv) Sulfur and accelerator should be added first to natural rubber during compounding.
(v) The term 'Rolling resistance' is associated with conveyor belt.

1 x 5 = 5

- 2.(a) Discuss the relative merits and demerits of radial and biased tyres.
(b) Why PCI is important for production of Nylon reinforced tyres.
(c) What are the important properties required for a truck tyre tread compound?
(d) Why Hardness of bead filler compound higher than side wall compound for a tyre?
(c) What are the different types of cords/textile materials used in tyre construction? Specify their application area with specific advantages

5 + 3 + 4 + 3 + 5 = 20

- 3.(a) What the different textile materials used in conveyor belt?
(b) Briefly describe the manufacturing of process for conveyor belt?
(c) Suggest base polymer/polymer blends for conveyor belt cover compound of the following grades and justify your answers.
(i) Super heat resistance (ii) Flame and fire resistance (iii) M-24
(d) Mention at least four important tests for conveyor belt.
(e) Write a brief note on RFL dipping of a polymeric fabric.

2 + 6 + 6 + 2 + 4 = 20

8. Write short notes on (Any Four)

- (i) Hardness testing of rubber and rubber-like materials
- (ii) Swelling resistance.
- (iii) Rolling resistance
- (iv) Manufacturing of Rubber Roller
- (v) Specification and Standardization
- (vi) Accelerated ageing test.

4 x 5 = 20