

INDIAN RUBBER INSTITUTE
PGDIRI EXAMINATION – 2011

Paper – IV

Date : 30th June, 2011
Duration : 3 Hours

Time : 14.00 – 17.00 hrs.
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. Multiple choice questions: select the correct answer from the given alternatives:

- (i) Drum friction test is relevant to
(a) Tyre (b) V-belt (c) Hose (d) Conveyor belt
- (ii) Which curing system gives maximum flex property?
(a) Peroxide cure (b) Semi efficient cure (c) Conventional cure (d) Efficient cure
- (iii) The highest voltage up to which paper insulation cable can be used
(a) 12kV (b) 33kV (c) 66kV (d) 100kV (e) 166kV
- (iv) Armour is a component of
(a) V-belt (b) Radial tyre (c) Cable (d) Hose
- (v) For a compound, $\tan \delta$ value at 60° gives an idea about
(a) Tear strength (b) Abrasion resistance (c) Rolling resistance (d) Wet traction
- (vi) Peel test is associated with
(a) Adhesion property (b) Tensile property
(c) Visco-elastic property (d) Electrical property
- (vii) The neutral angle associates with hose design is
(a) $55^\circ 44'$ (b) $44^\circ 54'$ (c) $54^\circ 44'$ (d) $44^\circ 55'$
- (viii) Aspect ratio of modern passenger car tyre is about
(a) 30% (b) 70% (c) 100% (d) 120%
- (ix) LPG tubing should be made from
(a) SBR (b) EPDM (c) Butyl (d) Polychloroprene rubber
- (x) Hardness of ebonite is measured in the durometer scale of
(a) Shore A (b) Shore B (c) Shore C (d) Shore D

- (xi) Width/height ratio in conventional wedge type V-belt is
 (a) 1.6/1.0 (b) 2.6/1.6 (c) 1.6/1.2 (d) 1.2/2.1
- (xii) Bias angle in bias ply tyres is
 (a) 30° (b) 54° (c) 65° (d) 90°
- (xiii) The term "last" is related to
 (a) Latex dipped products (b) Injection moulded products
 (c) Hot water bottle (d) Footwear
- (xiv) The term "compression ratio" is relevant to
 (a) Compression moulding (b) 2-roll mixing mill
 (c) 3-roll calender (d) Extruder
- (xv) Plunger test is used for
 (a) Conveyor belt (b) Hose (c) V-belt (d) Tyre
- (xvi) Corona resistance test is related to
 (a) Tyre (b) Cable (c) Conveyor belt (d) Hose
- (xvii) When a solid rubber ball is allowed to fall freely from a height of x cm and comes back to a height of y cm, the resilience of the ball material is given by
 (a) $\frac{1 - \cos x}{1 - \cos y}$ (b) $1/xy$ (c) y/x (d) x/y
- (xviii) In hydraulic hoses, the tube & cover should be made from
 (a) NBR & EPDM (b) IIR & CR (c) NBR & SBR (d) NBR & CR
- (xix) Nylon finds usage as reinforcing material in rubber product because of its
 (a) High elongation & high modulus.
 (b) High strength & high modulus.
 (c) High modulus & low elongation.
 (d) High strength & good resistance to fatigue.
- (xx) Property associated with change of stress with time when subjected under constant strain is
 (a) Creep (b) Set (c) Fatigue (d) Stress relaxation

(1 x 20) = 20

2. (a) Discuss the different carcass materials used in tyre manufacturing along with their merits and demerits.
 (b) Describe in brief the manufacturing process of auto passenger car tyre with a flow diagram.
 (c) Sketch the bead region of a tyre and explain function of the components.

(8+6+6) = 20

3. (a) Discuss the procedure of manufacturing long length rubber hose meant for oil at high pressure.
 (b) What is neutral angle of a high pressure braided hose and how is it related to the performance of hose?
 (c) Calculate the bursting pressure of a hose of bore 50 mm with tube thickness of 2.5 mm being braided with 480 nos of steel wire having breaking strength of 18 kg each (Tan $54^{\circ}44' = 1.414$ and Sine $54^{\circ}44' = 0.82$)

(8+6+6) = 20

4. (a) What necessary action will you take to prepare metal surface prior to bonding with rubber?
 (b) Describe briefly the manufacturing steps of any one metal to rubber bonded product.
 (c) What are the different methods of measurement of metal-rubber bond strength?
 (d) Formulate a metal bonded rubber seal. What type of bonding agent will you recommend for this product?

(4+7+5+4) = 20

GROUP - B

5. (a) What is the purpose of testing in rubber manufacturing unit ?
 (b) What is meant by "standards" and "specifications" ?
 (c) Discuss the basic aspects of quality assurance system in a rubber products manufacturing unit.

(4+8+8) = 20

6. Discuss the significance of the following testing –
 (a) Modulus at 100% or 300% elongation while elongation at break is also determined.
 (b) Compression set with respect to quality evaluation of a rubber gasket.
 (c) Cut growth of shoe sole while crack resistance is also tested.
 (d) Creep and stress relaxation while compression set is also determined.
 (e) Accelerated ageing in relation to quality of rubber products.

(4 x 5) = 20

7. (a) Explain the following terms of rubber properties.
 (i) Loss modulus
 (ii) Stress relaxation
 (iii) Creep
 (iv) Heat build up
 (v) Tear resistance

- (b) What is meant by swell index? What property of vulcanized rubber compound can be measured by swell index?
 (c) What is microcellular soie? How is it manufactured?

(10+5+5) = 20

8. Write short notes on (any four)
 (a) Tubeless tyres
 (b) Standard deviation and variance
 (c) Surface resistivity and volume resistivity.
 (d) Hysteresis and heat build-up.
 (e) Conditioning of test pieces before testing.
 (f) Heat setting of textiles.

(4 x 5) = 20