INDIAN RUBBER INSTITUTE
DIRI EXAMINATION – 2011

Paper – IV

Date : 30th June, 2011 **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. Select the correct answer from the given alternatives:

(i) The term "aspect ratio" is relevant for
(a) Cable (b) V-belt (c) Tyre (d) Seal

(ii) For acid resistant tank lining the most suitable rubber is
(a) Natural rubber (b) SBR (c) Nitrile rubber (d) Hypalon

(iii) The term "troughability" is relevant for
(a) Cable (b) V-belt (c) Tyre (d) Conveyor belt

(iv) For latex product the preferred accelerator is
(a) DPG (b) TBBS (c) ZDC (d) MBTS

(v) Tan delta value is a measure of
(a) Heat resistance (b) Oil resistance (c) Rolling resistance (d) Tear resistance

(vi) Silica and silane coupling agent are most important for
(a) Green tyre technology (b) Footwear technology
(c) Latex products (d) V-belt technology

(vii) Heat treatment is necessary for
(a) Rayon (b) Glass (c) Carbon fibre (d) Steel e) Nylon

(viii) Insulator is a component of
(a) V-belt (b) Radial tyre (c) Cable d) Hose

(ix) For tubeless tyre, air is carried by
(a) Tread base (b) Side wall (c) Breaker (d) Inner liner

(x) Rotocuring is related to
(a) Cable (b) V-belt (c) Tyre (d) Footwear

(xi) Specific operation related to auto tube manufacturing is
(a) Splicing (b) Braiding (c) Frictioning (d) Dipping

(xii) "Tangent delta" is the ratio of
(a) Storage modulus/ Loss modulus (b) Loss modulus/Storage modulus
(c) Complex modulus/Loss modulus (d) Loss modulus/Complex modulus

(xiii) Denier for a yarn is weight in gms for
(a) 9000 m of yarn (b) 900 m of yarn (c) 90 m of yarn (d) 1000 m of yarn.

(xiv) Resilience of a rubber compound
(a) Increases with filler loading (b) Increases with rise in temperature
(c) Increases with lowering of temperature (d) Increases with increase of hysteresis.

(xv) Best metal-to-rubber bonding results in unvulcanised compounds having
(a) Low sulphur dosage with fast-speed accelerators.
(b) Low sulphur dosage with slow-speed accelerators.
(c) Normal sulphur dosage with slow-speed accelerators.
(d) Normal sulphur dosage with fast-speed accelerators.

(xvi) In expanded micro-cellular sheet production, decomposition of blowing agent should take place
(a) At any time during curing (b) Simultaneously with on-set of curing
(c) Before on-set of curing (d) After on-set of curing.

(xvii) In latex dipped articles, commonly used coagulant is
(a) Calcium Nitrate (b) Potassium Nitrate (c) Hydrochloric Acid (d) Sulphuric Acid

(xviii) In braided hoses, if the braid angle is less than the neutral angle, the hose will
(a) Increase in diameter (b) Increase in length
(c) Increase in both diameter & length (d) Decrease in both diameter & length.

(xix) The term LOI is related to
(a) Ozone resistance (b) Fire resistance
(c) Abrasion resistance (d) Compression resistance

(xx) Most important property of oil seal is
(a) Tensile strength (b) Tear strength (c) Compression set resistance (d) Resilience

(20 x 1 = 20)

2. (a) Explain with diagram the functions of the primary components of a tyre.
(b) Discuss the relative advantages and disadvantages of radial and bias tyre.
(c) Write a compound formulation for a passenger radial tyre tread compound with justification.

(8+6+6) = 20

3. (a) How is latex compounding different from solid rubber compounding?
   (b) Give one example in each case for latex products made by dipping, extrusion and moulding.
   (c) Briefly describe the manufacturing process for **any one** of the latex products you mentioned along with the formulation.
   (d) Mention **any two** tests for the latex product you have discussed.

(5+3+10+2) = 20

4. (a) Discuss the salient features and functions of the primary components of a hose.
   (b) Describe briefly the manufacturing steps for a braided hose.
   (c) What is neutral angle? How braiding angle is related to neutral angle and performance of the hose?
   (d) Give a typical formulation of a cover compound for oil resistant hose.

(4+10+3+3) = 20

GROUP – B

5. (a) Explain briefly the significance of "standards" in rubber products.
   (b) Discuss the importance of "conditioning" of test pieces while testing.
   (c) Explain why tensile strength measurement is carried out as a routine quality control test even though very few rubber products are used without reinforcing members in tension.
   (d) Write down the units of
   i) Tensile strength ii) Tear strength iii) Resilience
   iv) Modulus at 100% elongation v) Compression Set.

(5 x 4) = 20

6. (a) What are the different fatigue tests that are generally carried out for rubber products?
   (b) Explain the behavior of NR vulcanizates and SBR vulcanizates towards flex cracking test.
   (c) Describe the Goodrich flexometer test for determination of heat-build up of a rubber vulcanizate.

(5+5+10) = 20

7. (a) The tensile strength of a given rubber specimen was found to be 20 MN per sq. m and the dumbbell specimen that was cut to give a sectional width of 6.0 mm. If the load at break was 250N, calculate the thickness of the specimen.
   (b) What is meant by accelerated ageing?
   (c) Describe accelerated ageing test in relation to tensile strength and elongation at break.

(8+4+8) = 20

8. Write short notes on (**any four**)
   (a) Permeability
   (b) De Mattia method
   (c) Peel test
   (d) Drum friction test of conveyor belt
   (e) DIN abrasion
   (f) Rebound Resilience.

(4 x 5) = 20