INDIAN RUBBER INSTITUTE
DIRI EXAMINATION – 2023

Paper – IV

Date : 10th March, 2024   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
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 x 20 = 20

1. Select the right answers from the given alternatives.

(i) Surgical gloves are made from latex by …………….. Process
    (a) Dipping   (b) Casting   (c) Moulding (d) Extrusion

(ii) For oil seal the most important property is
    (a) Resilience   (b) Compression set   (c) Tensile strength   (d) Elongation at break

(iii) Which is very specific operation in hose manufacturing?
    (a) Dipping   (b) Braiding   (c) Splicing   (d) Frictioning

(iv) The most suitable cord material for V-Belt reinforcement is
    (a) Nylon   (b) Polyester   (c) Steel   (d) Cotton

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

(vi) Tensile strength measurement of rubber is classified as a ………….. test
    (a) Mechanical (b) Thermal (c) Electrical (d) Chemical

(vii) For tubeless tyre, air is contained by
    (a) Tread base (b) Side wall (c) Breaker (d) Halo Butyl Inner liner

(viii) Mooney scorch time is the time required for the torque to rise …….. units above the minimum
    (a) 2   (b) 5   (c) 15   (d) 35

(ix) Endurance test is the test associated with
    (a) Footwear   (b) V-belts   (c) Tyre   (d) Cable

(x) The term Aspect Ratio is relevant for
    (a) Conveyor belt (b) Cable   (c) Tyre (d) Hose

(xi) Pneumatic tyre was invented by …..
    (a) John Boyd Dunlop   (b) Charles Goodyear (c) Thomas Hancock   (d) None of these

(xii) Denier is defined as the weight in grams of .... meters of yarn.
    (a) 90   (b) 900   (c) 9000   (d) 1000

(xiii) Which is very specific operation in automobile tube manufacturing?
    (a) Dipping (b) Braiding (c) Splicing (d) Frictioning

(xiv) In automobile tubes, EPDM is blended with Butyl rubber in order to improve
    (a) Ozone resistance (b) Air impermeability (c) Heat resistance (d) Tensile strength

(xv) Hardness of rubber is approximately related to
    (a) Tear property   (b) Set property   (c) Resilience   (d) Compression modulus

(xvi) Steel Belt is a component of ....
    (a) Cable   (b) Radial Tyre   (c) V-belt   (d) Hose

(xvii) Mould shrinkage p.c. of filled rubber compounds is usually
    (a) 0.10   (b) 1.5   (c) 3.5   (d) 4.5

(xviii) When a solid rubber ball is allowed to fall freely from a height of 10ft. and the ball bounce back to a height of 7ft. The resilience of the ball is ....
    (a) 30%   (b) 50%   (c) 70%   (d) 100%

(xix) For stabilization of latex the useful material is ....
    (a) $NaCl$ (b) H_2SO_4 (c) NH_3 (d) $CaCO_3$

(xx) Neutral angle in braided hose is . ...
    (a) 45°   (b) 39°   (c) 60°   (d) 54° 44'

<div align="right">8 + 12 = 20</div>

2.   (a) Name at least one important test for following products.
        (i) Tyre   (ii) Hose   (iii) V belt   (iv) Oil seal   (v) Cable (vi) Conveyor belt
        (vii) Engine mount   (viii) Shoe sole

    (b) Write the full form of the followings:
        (i) ISO (ii) ASTM (iii) LOI (iv) BIS (v) PCI (vi) kPa
        (vii) MPa (viii) RSS (ix) OTR (x) ATMA (xi) ODR (xii) SMR

<div align="right">(3+6+4+3+4) = 20</div>

3.   (a) What is meant by Abrasion Resistance Index?
    (b) Write briefly how the Abrasion Resistance of Rubber compound is measured.
    (c) How the values of Abrasion Resistance of Tyre tread compounds correlate the Mileage of Tyres?.
    (d) What do you mean by Shore A and Shore D?
    (e) Explain ML_{1+4} @100^0C =90.

<div align="right">10 x 2 = 20</div>

4.   Name the processes and the product for which following equipments/instrument are required
    (i) Braider (ii) Ball mill (iii) Bag-o-matic press (iv) Triple head extruder (v) Former
    (vi) Autoclave (vii) Rotocure (viii) Kneader (ix) β-scanned (x) 4 Bowl calendar

GROUP – B

<div align="right">4 + 4 + 3 x 4 = 20</div>

5. (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) Considering that you are the in-charge for quality control in a rubber moulding unit, mention the important tests that you would undertake for (i) raw materials (ii) in-process control and (iii) final moulded product giving reasons for your choice in **each** case.

<div align="right">10 + 10 = 20</div>

6. (a) Mention the appropriate units of the following properties with examples

(i) Hardness	(ii) Heat build-up	(iii) Tensile strength
(iv) Tear strength	(v) Flex crack resistance	(vi) Storage modulus
(vii) Specific gravity	(viii) Flame resistance	(ix) Torque in ODR.
(x) Abrasion resistance		

   (b) Using a Dunlop Tripso meter tester, a rubber compound was found to be a rebound angle of 30° with the vertical. If the initial angle of the pendulum at its releasing point was 45° with the vertical, calculate the % age resilience of the rubber under test.

<div align="right">8 + 6 + 6 = 20</div>

7. (a) Explain the following term of rubber properties
   (i) Stiffness   (ii) Creep   (iii) Heat build-up   (iv) Tear resistance

   b) Describe accelerated ageing test in relation to tensile strength and elongation at break

   c) Write the full form of the followings:
   (i) PRI, (ii) ISAF, (iii) DRC, (iv) IRHD, (v) ASTM, (vi) ISNR

<div align="right">4 x 5 = 20</div>

8. Write short notes on (**any four**)

   (i) Vulcanization of rubber
   (iii) Swelling resistance
   (iv) Goodrich Flexometer
   (v) Shoe sole & heal
   (vi) Fabric to rubber adhesion tests
   (vii) Drum friction test of conveyor belt