INDIAN RUBBER INSTITUTE
PGD-IRI EXAMINATION – 2013

Paper - IV

Date : August 11, 2013 **Time : 14.00 pm. - 17.00 pm.**
Duration : 3.00 hours **Full Marks : 100**

RUBBER PRODUCT MANUFACTURING AND THEIR EVALUATION

Answer should be illustrated with sketches wherever necessary.

Question No. 1 is compulsory. Answer **Four questions** from the remaining taking **Two** from each group.

GROUP – A

1. Select the correct answer from the given alternatives :

(i) The term "Run-Flat" is associated with.

(a) Conveyor Belt (b) V- Belt
(c) Tyre (d) Hose

(ii) Drum Friction test is relevant to :

(a) Tyre (b) Hose
(c) Conveyor Belt (d) V- Belt

(iii) Which curing system provides maximum flex properly :

(a) Efficient Curing (b) Peroxide Curing
(c) Conventional Curing (d) Semi-efficient Curing

(iv) Which one of the following has maximum high temperature shrinkage?

(a) Rayon (b) Polyester
(c) Nylon 6 (d) Nylon 66

(v) Aspect rario of tyre refers to ratio of :

(a) Section height and rim diameter
(b) Section height and width
(c) Section width and height
(d) None of the above.

(vi) The most suitable elastomer for tyre curing bag :

(a) Silicone (b) EPDM

(b) IIR (d) BR

(vii) Last is used for making:

(a) Latex dipped goods (b) Footwear

(c) Hot water bottle (d) Hydraulic Seals

(viii) In a braided hose, if the braid angle is less than the neutral angle, the hose will :

(a) Increase in diameter

(b) Increase in length

(c) Elongate in the direction 45^0 to the hoop force.

(d) Have no change during service.

(ix) The major function of the carcass plies in a pneumatic tyre is to :

(a) Provided rigidity and retain an inflated tire on the rim.

(b) Impart strength and contain growth.

(c) Brace the tread and maintain tread profile of an inflated tire.

(d) None of the above.

(x) In addition to excellent resistance to heat and humidity, aramid is well-known for its :

(a) Very good compressive properties

(b) Superior strength and modulus.

(c) Outstanding resistance to shear fatigue.

(d) None of the above.

(xi) If a solid rubber ball is freely falling from a height "X", bounce back to a height "Y", then the resilience of the ball can be estimated from,

(a) (1- cos X) / (1- cos Y) (b) 1+X / 1-Y

(c) Y/X (d) X / Y

(xii) Rotor of Mooney Viscometer rotates at a speed of :

(a) 3 rpm (b) 2 rpm

(c) 1 rpm (d) 5 rpm

(xiii) Ebonite contains sulphur :

(a) 10 phr (b) 35 phr

(c) 3.5 phr (d) 7 phr

(xiv) Foxing is one of the components of:

(a) Tyre (b) Rubber canvass foot wear

(c) Rain coat (d) Transmission belt

(xv) Magnetron is the source of energy for:

(a) Fluidised bed curing (b) Microwave curing

(c) Roto curing (d) Electron beam curing

(xvi) In crescent Tear Test, the result is expressed as:

(a) Tearing Load / Original cross-sectional area of sample.

(b) Tearing Load/ Width of sample.

(c) Tearing Load / Thickness of sample

(d) Tearing Load / Final cross-sectional area of sample.

(xvii) In which fibre the breaking strength increases in wet condition :

(a) Rayon (b) Polyester

(c) Cotton (d) Nylon

(xviii) Comparatively better metal-to-rubber bonding results from the curing system based on :

(a) Semi EV system (b) Peroxide system

(c) Conventional system (d) EV system

(xix) Which tread pattern of tyre provides, maximum steering response with even wear characteristics.

(a) Circumferential rib

(b) Lugged

(c) Ribs with side studs

(d) Asymmetrical transverse

(xx) Rubber Hardness has got close correlation with :

(a) Tear strength (b) Modulus

(c) Tensile strength (d) Elongation at break

(1 x 20 = 20)

2. (a) What are the differences between Radial and Bias tyre ? Also, mention the advantage of Radial tyre over Bias tyre.

(b) Explain the term 10.00-20 16 PR tyre. What is PCI and why it is necessary in tyre manufacturing?

(c) Write a suitable Tube formulation and give your justification for the choice of ingredients.

(d) Sketch Lug & Rib design of tyre tread. Also mention their fitment position in a vehicle.

(6+5+5+4=20)

3. (a) Describe briefly the manufacturing steps of a braided hose.

(b) Derive an equation for bursting strength of wrapped hose.

(c) What do you mean by Neutral Angle ? How braiding angle is related to neutral angle and performance of the hose ?

(d) Formulate a cover compound for oil resistant hose.

(8+5+3+4=20)

4. (a) What is V-belt ? Where it is used?

(b) What do you mean by classical V-belt and wedge type V-belt?

(c) Describe the manufacturing process of V-belt.

(d) Write on the Life Testing of V-belt.

(3+4+10+3 = 20)

GROUP – B

5. (a) What is meant by **"Standards and Specifications"**?

   (b) Write briefly, how the Quality Assurance Activity is conducted in a rubber product manufacturing unit?

   (c) What is meant by swelling index ? What property of vulcanized rubber compound can be measured by swelling index ?

   (7+8+5 = 20)

6. (a) Write briefly how the Rebound Resilience and Heat build-up of rubber compounds are measured?

   (b) Explain, how the above both properties correlate with the performance of Truck Tyre Tread?

   (c) Using a Dunlop Pendulum tester, a rubber compound was found to give a rebound angle of 30^0 with the vertical. If the initial angle of the Pendulum at its release point was 45^0 with the vertical, calculate the rebound resilience of the rubber compound under test. (Given cos 30^0 = 0.866 and cos 45^0 = 0.707).

   (d) Determine the weight per Sq. Mtr. of a finished calendered rubber of thickness 1.15 mm. having specific gravity 1.3.

   (7+6+4+3= 20)

7. (a) Write appropriate units for the following measurement parameters.
   (i) Tensile strength and Tear strength.
   (ii) Abrasion loss.
   (iii) Modulus at 300% elongation.
   (iv) Rebound Resilience and Heat Build-up.
   (v) Volume Resistivity.
   (vi) Maximum Torque by MDR.
   (vii) Thermal Conductivity.
   (viii) Rolling Resistance.
   (ix) Acid Value.
   (x) Surface area of carbon black.

(b) Calculate the specific gravity and the cost / kg. and cost / litre of the rubber compound made from the formulation given below :

Ingredients	Phr	Sp. Gravity	Rs. / Kg.
SBR	60	0.94	250
BR	40	0.93	200
Zinc Oxide	4	5.5	180
Stearic Acid	2	0.85	60
Antioxidant, 6PPD	2.5	1.1	300
N 330 black	55	1.8	80
Aromatic Process Oil	6	0.85	60
Sulfur	1.5	2.0	20
Accelerator, BSM	1.5	1.35	250

(10 +10 = 20)

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

(a) Stress relaxation and creep.

(b) Preparation of Hand Gloves from Latex

(c) Peel Adhesion Test.

(d) Shoe soles & heels.

(e) Metals surface preparation for bonding with rubber.

(f) Effect of curing system on flexing, Compression set and Heat resistance.

(g) Insulation of cable.

(4 x 5= 20)