INDIAN RUBBER INSTITUTE

PGD-IRI 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. Select the correct answers from the given alternatives :

(i) Which of the following operation is not associated with tyre manufacturing?
(a) Extrusion (b) Calendaring (c) Dipping (d) Braiding

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

(iii) Reclaim rubber can be used in
(a) Scooter tyre (b) Cycle tyre (c) Passenger car tyre (d) OTR

(iv) LPG (Domestic gas) tubing should be made with
(a) SBR (b) Butyl rubber (d) Polychloroprene (c) EPDM

(v) To cure a thick rubber product one should use
(a) Shorter time at higher temperature
(b) Shorter time at low temperature
(c) Longer time at elevated temperature
(d) Longer time at lower temperature

(vi) 'Peel' test is associated with
(a) Bond testing of fabric to rubber (b) Moulded rubber
(c) Hose (c) Fabric abrasion

(vii) The textile-to-rubber adhesion strength is generally expressed as
(a) Only breaking load irrespective of sample dimension
(b) Breaking load/thickness of the sample
(c) Breaking load/width of the sample
(d) Breaking load/area of the sample

(viii) The minimum moisture regain takes place with
(a) Rayan (b) Polyester (d) Nylon (c) Cotton

[TURN OVER]

(ix) Included angle in V-belt and braiding angle in hose should be respectively
(a) 54° & 44° (b) 30° & 44° (c) 40° & 54° (d) 64° & 54°

(x) In Crescent tear test, the result is expressed as
(a) Tearing load/final cross-sectional area of sample
(b) Tearing load/width of sample
(c) Tearing load/thickness of sample
(d) Tearing load/original cross-sectional area of sample

(xi) The most important property requirement for oil seal and gasket
(a) Tear strength (b) Compression set
(c) Tensile strength (d) Elongation at break (e) Stress relaxation

(xii) Corona resistance test is important for
(a) Cable (b) Metal-rubber bonding (c) Shoe sole (d) Latex thread

(xiii) In a braided hose, if the braid angle is greater than the neutral angle, the hose will;
(a) Have no change during service
(b) Decrease in diameter
(c) Decrease in length
(d) Elongate in the direction 45° to the hoop force

(xiv) The highest voltage up to which paper insulated cable can be used
(a) 12 kV (b) 33 kV (c) 6 kV (d) 66 kV (e) 166 kV

(xv) Collapsing of latex foam after vulcanisation can be controlled by
a) Reducing gelling time (c) Increase gelling time
b) Increasing foam time (d) Readucing foam time

(xvi) Skid resistance is a term related to
(a) V-belt (b) Conveyor belt (c) Tyre (d) Hose

(xvii) Silane coupling agent is used in Cable insulating compound to improve
(a) Tensile strength & heat build up (b) Over all mechanical & wet electrical properties
(c) Dielectric constant & loss factor (d) Heat resistance & electrical resistance

(xviii) A solid rubber ball is allowed to free fall from a height of 10 ft. on a hard surface in the ball bounce back to a height 7 ft. The resilience of the ball is
(a) 30 % (b) 50 % (c) 70 % (d) 100 %

(xix) The suitable textile material for cat-edge conveyor belt reinforcement
(a) Rayon (b) Glass (c) Steel (d) Nylon

(xx) Life testing is the most important test for

(a) Tyre (b) V-belt (c) Hose (d) Cable (1 x 20) = 20

2.(a) Draw a section diagram of a Bias ply tyre indicating its various components.

(b) What are the advantages of radial ply tyre over Bias types?

(c) Mention the comparative advantages of nylon tyre cord over rayon tyre cord.

(d) What is PCI and why it is necessary in tyre manufacturing?

(d) What are the important properties required for passenger car tyre tread compound?

(7+3+3+4+3) = 20

3.(a) Give the process flow chart of rubber to metal bonding including metal surface preparation.

(b) What are the different methods of measurement of metal-rubber bond strength?

(b) What are various process of manufacturing rubber articles from latex?
Give example of products associated with each.

(c) How household globes are made from latex? Give a typical compound of household globe?

(4+5+6+5) = 20

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

(b) Derive an equation for bursting strength of wrapped 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°44' = 1.414 and Sine 54°44' = 0.82)

(9+5+6) = 20

GROUP – B

5.(a) Mention a few important destructive and non-destructive tests for tyre.
Briefly describe one of them.

(b) How metal-rubber bonding is tested?

(c) What are the important tests for oil seal and gaskets?

(d) What are the different methods for measuring fabric to rubber adhesion strength?

(5 x 4) = 20

6.(a) What is meant by "Standards and Specification"?.

(b) Write down briefly the basic aspects about quality assurance activity in a manufacturing unit.

(c) Name a few important processing equipment used in the rubber industry. Mention the process for which they used. (7+7+6) = 20

7. Calculate the specific gravity and the cost/kg and cost/litre of the rubber compound made from the formulation shown below:

Phr	Sp. Gravity	Rs/Kg
NBR	100	0.98	250
Zinc oxide	5	5.5	200
Stearic acid	1	0.85	50
Antioxidant, TMQ	2	1.1	200
N 550 black	50	1.8	50
Dioctyl phthalate	10	0.8	100
Sulfur	1.5	2	20
MBTS	1.5	1.3	170
TMTD	0.5	1.4	100

What changes would you make to improve heat resistance?

What changes would you expect if N550 is replaced by N330?

(8+8+2+1+1) = 20

8. Write short notes on (**Any Four**)

(a) Manufacturing of rubber rolls

(b) Rolling resistance

(c) Curing of hose

(d) High voltage cable insulating materials and properties

(e) Hysteresis and heat build-up.

(f) Heat setting of textiles.

(4 x 5) = 20