INDIAN RUBBER INSTITUTE

PGD-IRI EXAMINATION – 2016

Paper - IV

Date: 23.07.2016 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. From **Question No. 1** is compulsory. Answer **FOUR** from the remaining questions taking TWO from each group.

GROUP – A

1. Choose the correct answer from the given alternatives :

(i) Cycle tyre cord is mainly derived from

(a) cotton (b) nylon (c) rayon (d) polyester

(ii) Tyre side walls are made thin

(a) for better heat dissipation (b) as no abrasion is needed in side wall

(c) for better economy (d) none of these

(iii) For acid resistant tank lining the most suitable rubber is

(a) Natural rubber (b) SBR (c) Nitrile (d) Hypalon

(iv) Drum friction test is relevant to

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

(v) The term 'Run-Flat' is associated with

(a) Tyre (b) Conveyor belt

(c) Hose (d) V-Belt

(vi) The single most property requirement of rubber covered rolls is

(a) Hardness of the rubber (b) Diameter of the core

(c) Adhesion to the core (d) Thickness of the cover

(vii) Most suitable reinforcing cord material for V-belt is

(a) Nylon (b) Polyester (c) Rayon (d) Cotton

(viii) The best metal-to-rubber bonding results from the curing system based on :

(a) EV system (b) Semi EV system (c) Conventional system (d) Peroxide system

(ix) Which rubber does not form ebonite, through sulphur curing ?

(a) NR (b) SBR (c) NBR (d) IIR

(x) Maximum tenacity (gpd) is given by
(a) Rayon (b) Nylon (c) Polyester (d) Cotton

(xi) In which fibre the breaking strength increases in wet condition.
(a) Rayon (b) Cotton (c) Polyester (d) Nylon

(xii) Which tread pattern of tyre provides the maximum steering response with even wear characteristics
(a) Circumferential rib (b) Lugged
(c) Ribs with side studs (d) Asymmetrical transverse

(xiii) Maximum impulse resistance in high pressure hose is provided by the construction.
(a) Wrapped ply (b) Braiding (c) Knitting (d) Spiraling

(xiv) Angle of steel cords in the belt of a radical tyre is
(a) $12^{o} - 18^{o}$ (b) $25^{o} - 30^{o}$ (c) $35^{o} - 40^{o}$ (d) $85^{o} - 90^{o}$

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

(xvi) In latex foam production the post vulcanization collapse can be controlled by
(a) increasing vulcanization time (b) reducing foaming time
(c) reducing gelling time (d) increasing gelling time

(xvii) If the volume of the mould is V, then the volume of initial compound used for preparation of micro cellular rubber should be roughly
(a) 1.7 V (b) V (c) 0.7 V (d) None of the these

(xviii) The property associated with change of stress with time when a rubber sample is held under constant strain is :
(a) Creep (b) Stress relaxation (c) Set (d) Fatigue

(xix) The polymeric material will be highly flammable if its LOI is
(a) 60 (b) 48 (c) 18 (d) 27

(xx) For coagulation of latex the useful material is
(a) Acetic acid (b) Silica (c) NH_3 (d) $CaCO_3$

(1 x 20) = 20

2. a) Sketch the different components of a Cable?

b) Write a typical formula for high quality heat resistant Cable Cover compound. Explained the reasons for the choice of ingredient.

c) Compare aluminium and copper as a cable conductor.

d) What is break down voltage and how can it be measured ?

(4+6+5+5) = 20

3. a) Match the column 'A' with the Column 'B' and mention the appropriate SI units in Column 'C' of the test mentioned in Column A.

	Column – A	Column – B	Column – C
1.	Elongation at break	Hysteresis	
2.	Modulus	Adhesion between reinforcing material and rubber	
3.	Compression set	Stress at specific elongation	
4.	Resistivity	Strain at failure	
5.	Heat build up	Conductive and antistatic rubber product	
6.	Peel strength	Extent of recovery from large deformation	

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

c) Determine the weight per sq. Mtr of a finished calendered rubber thickness 1.15 mm having specific gravity 1.3.

(12+ 3+ 3 + 2) = 20

4. a) What is conveyor belt and where it is used ?

b) In conveyor belt terminology what do you mean by M-24, N-17, EP & PP?

c) What is troughability and how can it be measured ?

d) Select suitable base rubber / rubber blends for conveyor compound for following conveyor belts and justify your answer.

(i) Super heat resistant

(ii) Flame and fire resistant

(iii) Standard abrasive grade requiring good mechanical properties.

(iv) Conveyor belt for coal mine.

(4+ 6 + 4 + 6) = 20

Group – B

5. a) Explain with diagram the different types of casing constructions as used in tyres.

b) Write a compound formulation for a truck tyre tread mentioning the function of each ingredient used.

c) Briefly explain the function of a bead in a tyre.

(9 + 7 + 4) = 20

6. a) Describe the basic construction of classical V-belt with diagram and explain the function of each component.

b) Write down the main factors to be considered while selecting the reinforcing materials for construction.

c) Draw a flow diagram for the manufacturing process.

d) What type of rubber is to be used in base, cushion and jacket compound?

(6 + 5 + 6 + 3) =20

7. a) What is the significance of Swelling Test?

b) Mention two areas of application where swelling test is important.

c) Arrange the following elastomers from highest to lowest with respect to swelling in mineral oil.

(i) NR (ii) CR (iii) FKM

d) Arrange the following elastomers from highest to lowest in order of their resistance to acids.

(i) SBR (ii) CR (iii) CSPE

e) Immersion of a vulcanized rubber sample in petrol caused its weight to increase from 5.26 gm. to 7.43 gm. and its weight when fully immersed in water to decrease from 1.91 gm. to 1.17 gm. Calculate the percentage change in volume of the vulcanizate caused by immersion.

(2 + 2 + 3 + 3 + 10) =20

8. Write short notes on any four of the following :–

a) Effect of curing system on fatigue, compression set and heat resistance

b) Manufacturing of a tennis ball

c) Preparation of hand gloves from latex

d) Manufacture of rubberized gum boot

e) Effect of base rubber, filler & plasticizer on metal-rubber bonding

f) Metal surface preparation for bonding with rubber

5x4=20