INDIAN RUBBER INSTITUTE
PGD-IRI EXAMINATION – 2014

Paper - IV

Date: 12 July, 2014 **Time: 14.00 - 17.00 hrs**
Duration: 3 hours **Full Marks: 100**

RUBBER PRODUCT MANUFACTURING & THEIR EVALUATION

Answer should be illustrated with sketches wherever helpful

Total Five questions are to be answered. Each question carries 20 marks.
Question No. 1 is compulsory. Answer **Four questions** from the remaining taking **Two** from each group.

GROUP – 'A'

Q. 1. Write down the correct answer from the following :-

(i) Peroxide vulcanization is commonly used for following rubber product :
(a) Tyre (b) Conveyor belt (c) Hose (d) Cable

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

(iii) Most suitable reinforcing cord material for V-belt is
(a) Nylon (b) Polyester (c) Rayon (d) Cotton

(iv) Comparatively better metal-to-rubber bonding results from the curing system based on :
(a) EV system (b) Semi EV system (c) Conventional system (d) Peroxide system.

(v) In Peroxide curing system, most effective method for reduction of curing time is :
(a) to increase the dosage of peroxide, (b) to increase the curing temperature
(c) to increase the moulding pressure. (d) to add some rubber accelerator.

(vi) Which rubber does not form ebonite, though curable with sulphur;
(a) NR (b) SBR (c) NBR (d) IIR

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

(viii) In expanded micro-cellular sheet, decomposition of blowing agent should take place-
(a) Before on-set of curing, (b) after on-set of curing;
(c) Simultaneously with on-set of curing (d) at any time during curing.

(ix) Included ingle in V-belt and braiding angle in hose should be respectively
(a) 30^0 & 44^0 (b) 40^0 & 54^0 (c) 54^0 & 44^0 (d) 64^0 & 54^0

(x) The most suitable rubber for inner liner of tubeless tyre,
(a) BR (b) SBR (c) IIR (d) BIIR.

(xi) The minimum moisture regain takes place with
(a) Cotton (b) Nylon (c) Rayon (d) Polyester.

(xii) The maximum dimensional stability is shown by conveyer belt reinforced with
(a) Rayon (b) Nylon (c) Polyester (d) Steel cord

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

(xiv) For semi-conducting component in high voltage cable which filler should be used
(a) Calcined clay (b) Calcium carbonate (c) Carbon black, (d) Silica .

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

(xvi) Maximum fatigue resistance in a textile is shown by
(a) Cotton (b) Rayon (c) Nylon (d) Polyester

(xvii) Angle of steel cords in the belt of a radial tyre is
(a) $12^0 - 18^0$ (b) 25^0 - 30^0 (c) 35^0 - 40^0 (d) 85^0 - 90^0

(xviii) Textile to rubber peel adhesion test is carried out at a traversing speed of
(a) 450mm/min. (b) 350 mm/min. (c) 250 mm/min. (d) 100mm/min.

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

(xx) The suitable rubber for super heat resistant conveyor belt cover compound should be made from
(a) SBR (b) NBR (c) IIR (d) EPDM

(1 x 20) = 20

Q.2. (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 ingredients used.
(c) Briefly explain the construction and function of a bead in a tyre.

(9 + 6 + 5) = 20

Q.3.(a) Describe the basic construction of classical V-belt with diagram and explain the function of each component.
(b) What do you mean by drum friction test for conveyor belt and life testing of V-belt?.
(c) Briefly describe the manufacturing process with flow chart for classical V-belt.

(6+4+10) = 20

Q.4. Write short notes on any **Four** of the following.
(a) How latex compounding is different from solid rubber compounding.
(b) Moulded hose
(c) Metal surface preparation for metal-rubber bonding.
(d) O-ring manufacturing.
(e) Manufacturing of rubber rolls.
(f) Curing of hose or/cable.

(4 x 5) = 20

GROUP – B

Q.5. (a) Mention the various processes of manufacturing rubber articles from latex giving one example of product associated with each.
(b) Briefly describe the manufacturing process for any one of the latex product that you have mentioned.
(c) Write a suitable formulation for that latex product mentioning the function of each compounding ingredient used.

(6+7+7) = 20

Q.6. Write shot notes on **any Four** of the followings
(a) High voltage cable insulation materials & properties.
(b) Shoe soles and heels.
(c) Manufacturing of hawai sole.
(d) Tank lining
(e) Conveyor belt cover compounds
(f) Heat build up & resilience tests for rubber

(4 x 5) = 20

Q.7. (a) Define the terms "hysteresis loss" and "damping" as applied to rubber vulcanisates. Is there any relation between these two properties?

(b) How these properties correlate with the service performance of finished products.

(c) During the loading of a vulcanizate, the extension produced by the load was recorded and the data are shown in the table below. The table also shows the value of extension during unloading.

Load (Kgf)	Extension during loading (cm.)	Extension during unloading (cm.)
0	0	5.1
0.5	1.0	6.3
0.75	2.7	6.7
1.0	4.2	7.0
1.5	5.6	7.6
2.0	6.5	8.0
3.0	7.7	8.7
4.0	8.75	9.4
5.0	9.7	10.0
6.0	10.3	10.6
7.0	10.75	10.8
7.5	10.0	-

From the appropriate graph, determine the energy absorbed by the vulcanizate in this stress-strain cycle and calculate the elongational set and also indicate these properties in the plot. State clearly the units of your answer.

(6+4+10) = 20

Q.8. (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 degree of swelling in mineral oil, and justify your answer.

(i) NR (ii) CR (iii) NBR(25% ACN content) (iv) NBR(45% ACN content)

(d) Arrange the following elastomers from highest to lowest in order of their resistance to mineral acids and justify your answer

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

(e) Immersion of vulcanized rubber sample in petrol (specific gravity = 0.9) caused its weight to increase from 5.0 gm. to 7.43 gm. and its weight when fully immersed in water to decrease from 5 gm. to 1.7 gm. Calculate the percentage change in volume of the vulcanisate caused by immersion in petrol.

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