INDIAN RUBBER INSTITUTE
PGDIRI EXAMINATION – 2012

Paper – IV

Date : 21st July, 2012 **Time : 14.00 – 17.00 hrs.**
Duration : 3 Hours **Full Marks : 100**

Rubber Product Manufacturing and Their Evaluation

Answer **Question No. 1** and **any four** from the rest taking **two questions** from **each group**. Each question carries 20 marks

GROUP – A

1. Multiple choice questions: select the correct answers from the given alternatives:

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

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

(iii) Cycle tyre cord is mainly derived from
(a) Cotton (b) Nylon (c) Glass (d) Polyester (e) Rayon

(iv) Air craft tyre is based on .....
(a) NR-SBR blend (b) NR-BR blend (c) Neat NR (d) SBR-BR blend

(v) Tyre side walls are made thin because .....
(a) For better heat dissipation due to high dynamic flexing (b) As no abrasion resistance is needed for side walls (c) For better economy (d) Lower road grip

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

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

(viii) Why iron is not selected as cable conductor because it has
(a) Poor fatigue resistance (b) Density is very high (c) Poor electrical conductivity
(d) It gets rusted easily (e) Poor thermal conductivity

(ix) 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
(e) Flame & fire resistance

(x) The most suitable reinforcing cords for radial tyre belt & V belt are respectively,
(a) Steel cord and polyester cord (b) Polyester cord & glass cord (c) Nylon cord & polyester cord
(d) Rayon cord & Nylon cord (e) Glass cord & polyester cord

(xi) 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

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

(xiii) The most suitable textile reinforcement for aero-tyre is
(a) Polyester (b) Nylon 66 (c) Steel cord (d) Carbon fibre (e) Nylon 6

(xiv) PCI is not required if the tyre is made up of
(a) Nylon 6 (b) Polyester (c) Nylon 66 (d) Rayon

(xv) The most popular belt material used in radial tyre
(a) Nylon (b) Polyester (c) Steel (d) Rayon

(xvi) Trough-ability testing is the most important test for
(a) Tyre (b) V-belt (c) Conveyor belt (d) Cable

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

(xviii) Artificial heart valve is made from
(a) FKM (b) MQ (c) SBR (d) NR

(xix) Buttress region is a term related to
(a) Tennis ball (b) Shoe (c) Hot water bag (d) Tyre

(xx) Unit of flex cracking resistance
(a) Kg/Cm^2 (b) No of cycle (c) Kg-Cm (d) Kg/Cm

(1 x 20) = 20

2. (a) Draw a section diagram of a radial ply tyre indicating its various components.
(b) What are the advantages of radial ply tyre over other types?
(c) Mention the comparative advantages of nylon tyre cord over rayon tyre cord.
(d) How automobile inner tube is manufactured now-a-days?
What is the of basis selection of polymer for this product?

(8+3+3+6) = 20

3. (a) Give the process flow chart of rubber to metal bonding.
(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?
(d) Define sponge, cellular and expanded rubber? How micro-cellular soling manufactured?

(4+5+5+6) = 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 one method of V-belt building and curing.
(d) What do you mean by life testing of V-belt?

(3+4+10+3) = 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) Describe briefly the manufacturing steps for braided hose.
   (b) Derive an equation for bursting strength of braided hose.
   (c) What is neutral angle? How braiding angle is related to neutral angle and performance of the hose?
   (d) Formulate a inner liner compound for oil resistant hose.

(10+4+3+3) = 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	150
Zinc oxide	5	5.5	120
Stearic acid	1	0.85	50
Antioxidant, TMQ	2	1.1	160
N 550 black	50	1.8	50
Dioctyl phthalate	10	0.8	90
Sulfur	1.5	2	15
MBTS	1.5	1.3	170
TMTD	0.5	1.4	100

How will you ensure good dispersion of the curing agent?
What changes would you make in the recipe for better low temperature flexibility?
What changes would you make to improve heat resistance?
How can the ozone resistance be improved?
What changes would you expect if N550 is replaced by N330?

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

8. Write short notes on **(any four)**
   (a) Manufacturing techniques of common seals.
   (b) Continuous vulcanization of cable
   (c) Manufacture of latex foam
   (d) Fabric-rubber adhesion test
   (e) Continuous curing by Rotocure
   (f) Manufacturing of microcellular sheet

(5 x 4) = 20