# INDIAN RUBBER INSTITUTE

## DIRI EXAMINATION – 2012

**Paper – III**

**Date : 21st July, 2012** **Time: 10.00 – 13.00 hrs.**
**Duration : 3 Hours** **Full Marks: 100**

**Rubber Materials, Rubber Compounding and Reinforcement**

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. (a) Write full form of the followings :
MQ, HNBR, CR, IR, CIIR, FEF, MT, MBT, DCP, TMTD.
**1 x 10 = 10**

(b) Choose the right answers from the given alternatives:

(i) Which of these SBR grades is oil extended grade?
(i) SBR 1500 (b) SBR 1502 (c) SBR 1700 (d) SBR 1958

(ii) Technically specified natural rubber ISNR 20 is in the form of
(a) Pellets (b) Slabs (c) Crumbs (d) Sheets

(iii) Which of these fillers is most widely used in cycle tyre tread
(a) China clay (b) HAF Carbon black (c) Silica (d) Calcium silicate

(iv) Which metal oxide is commonly used as an curative for neoprene compound
(a) Lead oxide (b) Titanium dioxide (c) Calcium oxide (d) Zinc oxide

(v) Which of these blends can be used for inner liner of tubeless tyre
(i) NR-SBR (ii) NR – BR (iii) BR – SBR (iv) BIIR-NR

(vi) Bonding agent used for fabric rubber bonded product is.
(a) Chemlok (b) RFL (c) PF resin (d) CI resin

(vii) Which of these fillers have the highest specific gravity?
(a) Carbon black (b) Calcium carbonate (c) Aluminium Silicate
(d) Barium sulphate

(viii) For coagulation of latex useful material is
(a) NaCl (b) $CH_3COOH$ (c) $NH_3$ (d) $CaCO_3$

(ix) Most suitable elstomer for steam hose
(a) Silicone (b) Butyl (c) Polybutadiene (d) EPDM

(x) Cord used in cycle tyre body ply
(a) Steel (b) Carbon (c) Nylon (d) Cotton
**1 x 10 = 10**

2. (a) Describe the method for production of any RMA grade of Natural Rubber.
(b) How grading of nitrile rubber is done?
(c) Define Plasticity Retention Index (PRI).
(d) Select grade of natural rubber for truck tyre and cycle tyre.

**10+4+3+3 = 20**

3. (a) What are different grades of SBR used in rubber industry ?
(b) Select grades of SBR used in car tyre tread & shoe sole.
(c) Name a few important non-black fillers.
(d) What properties will improve due to addition of carbon black in rubber compound?

**5+4+3+8 = 20**

4. Write short notes on following rubber compounding and processing materials:

(a) Dusting agent
(b) Accelerator
(c) Antioxidant
(d) Peptizer
(e) Retardar

**4 x 5 = 20**

## GROUP – B

5. (a) Design a compound for good quality cycle tyre tread.
(b) Give reasons for the choice of polymer and ingredients for the same.
(c) What will you do if you have to reduce the price of this tread compound?

**8+7+5 = 20**

6. A compound is given below:

| Ingredients | phr | Specific gravity | Cost (Rs.per kg) |
|---|---|---|---|
| NR | 100 | 0.92 | 90 |
| ZnO | 5 | 5.5 | 80 |
| Stearic acid | 3 | 0.85 | 60 |
| Antioxidant TMQ | 2 | 1.1 | 200 |
| N330 black | 60 | 1.8 | 50 |
| Aromatic oil | 8 | 0.98 | 40 |
| MBT/TMTD | 1.0/0.2 | 1.3/1.2 | 300 |
| Sulphur | 2.5 | 2 | 20 |

Calculate the specific gravity of the compound and the cost per unit weight and volume. Suggest what changes you would make to:

(a) Reduce the heat build of the tread.
(b) Improve the scorch safety of the compound.
(c) Improve the ozone and weathering resistance of the tread.

**8 + 4 + 4 + 4 = 20**

7. Mention a few important properties & applications for following rubber/ blends giving brief reasons for the same :

(a) SBR 1958
(b) BIIR
(c) EPDM
(d) PVC-NBR blend
(e) RMA-5
(f) NR-SBR blend
(g) CR
(h) PU
(i) BR
(j) MQ

**10 x 2 = 20**

8. Write short notes on : (**<u>any four</u>**) :

(a) Reclaim rubber
(b) Non black filler
(c) Plasticizer
(d) Tackifier
(e) Sulfur less curing agent

**5 x 4 = 20**