

# INDIAN RUBBER INSTITUTE

## DIRI EXAMINATION – 2022

### Paper – III

Date : 26<sup>th</sup> March 2023  
Duration : 3 Hours

Time: 10 AM to 1 PM  
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) 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) The lowest particle size black  
(a) N774 (b) N990 (c) N110 (d) N330
- (iii) Which type of the compound are the most staining type anti-oxidant?  
(a) Phenol (b) Phosphate (c) Amine (d) Carboxylic acid
- (iv) Which materials is commonly used as an curative for EPR compound ?  
(a) Lead oxide (b) Peroxide (c) Sulfur (d) Resin
- (v) Nylon is a :  
(a) Polyester (b) Polyimide (c) Polyamide (d) Polycarbonate
- (vi) Bonding agent used for fabric rubber bonded product is.  
(a) Chemlok (b) RFL (c) PF resin (d) CI resin
- (vii) One of the major drawback of Polybutadiene Rubber is :  
(a) High Rebound Resilience (b) Poor Processability  
(c) High Heat resistance (d) Resistance to Polar solvents
- (viii) Wood rosin is used in Rubber compounds as :  
(a) Crosslinking agent (b) Tackifier (c) Peptiser (d) Accelerator
- (ix) Colloidal dispersion of Sulfur is used as crosslinking agent is :  
(a) Latex Products (b) Tank Lining  
(c) Metal to Rubber Bonding (d) Tyre
- (x) Which of the following oils will have lowest aniline points?  
(a) Aromatic oil (b) Paraffinic oil  
(c) Napthenic oil (d) Vegetable oil

- (xi) Sulfur monochloride is used in rubber for  
 (a) Curing at high temperature (b) Retarding cure  
 (c) Curing at low temperature (d) Better dispersion
- (xii) Which of these blends would give good abrasion and low heat build up?  
 (a) NR-SBR (b) NR-BR (c) BR-SBR (d) IIR-SBR
- (xiii) Function of  $MgO$  in Neoprene rubber is primarily as:  
 (a) Accelerator (b) Filler (c) Process aid (d) Acid acceptor
- (xiv) MC wax is used in rubber primarily as a :  
 (a) Process aid (b) Antioxidant (c) Antiozonant (d) Activator
- (xv) Identify the blowing agent used in rubber:  
 (a) ADC (b) DPG (c) ZMBT (d) ZDBC

1 x 15 = 15

- (b) Write full form of the following  
 TMTD, DCP, MBT, FEF, RFL

1 x 5 = 5

2. (a) Define thermoplastics elastomers (TPE) and how they differ from thermoset elastomers (TPV)  
 (b) Give the different benefits of use of thermoplastics elastomers?  
 (c) What do you understand by SBS, SIS and SEBS?  
 (d) Explain phase morphology of SBS obtained from Differential Scanning Calorimeter thermogram.

6+4+6+4 = 20

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

5+4+3+5 = 20

4. a) What are different Furnace Blacks available for Rubber Industry?  
 b) Explain the ASTM Classification of N339 Black.  
 c) Explain the term Structure of carbon black? What is the method for determination of structure? What do you mean by particle size and surface area of carbon black?  
 d) Explain in short the following terms in carbon black.  
 i) Ash content ii) Toluene Discolouration iii) pH

5+3+(2+2+2)+6 = 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 is factice? Differentiate between white factice and brown factice with regards to their structure, properties and performance.

7+6+2+5 = 20

2/3

6. A compound is given below:

<u>Ingredients</u>	<u>phr</u>	<u>Specific gravity</u>	<u>Cost (Rs. per kg)</u>
NR	100	0.92	210
ZnO	5	5.5	100
Stearic acid	3	0.85	50
Antioxidant TMQ	2	1.1	210
China Clay	40	2.65	4
N330 black	30	1.8	80
Aromatic oil	8	0.98	40
MBT/TMTD	10 <del>1.0</del>	1.3	300
TMTD	0.2	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 would you make to:

- Reduce the heat build of the tread.
- Improve the scorch safety of the compound.
- Improve the ozone and weathering resistance of the tread.
- Higher tensile strength.

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

7.

- Discuss the structure of chlorosulfonated polyethylene (CSPE) and express the chlorine content and sulphur content in it.
- What are the different ways CSPE can be crosslinked? State the mechanism of crosslinking reactions.
- Discuss the influence of acrylonitrile content of NBR on their properties.
- Name and compare various grades of CR.
- Mention a few important properties and applications for the following rubber giving brief reason for the same.
  - MQ
  - BIIR
  - EPDM
  - PU

4x4 = 20

8. Write short notes on : (any four) :

- Dip coating of synthetic cords/fabrics
- Non black fillers
- Metal-rubber bonding
- Prevulcanised Latex
- Latex compounding
- Blowing agent

4 x 5 = 20