

# INDIAN RUBBER INSTITUTE

## DIRI EXAMINATION – 2019

Paper III

Date: 7<sup>th</sup> July, 2019

Time: 10.00 – 13.00 hr

Duration: 3 hr

Full Marks: 100

Rubber Materials

Answers should be illustrated with sketches wherever necessary. Total Five questions to be answered. Each Question carries 20 marks.

Question No 1 is compulsory. Answer rest four (4) questions, taking two from each group.

### Group A

- I. Multiple choice type questions. Select the correct answer from the given alternatives.
  - i) Which Polymer Swells the least in petrol?  
a) BR    b) EPDM    c) SBR 1712    d) CSM ✓
  - ii) Which rubber possesses highest self protection in Ozone?  
a) NR    b) NBR    c) BR    d) EPDM
  - iii) ZnO is used as the Curing agent for  
a) NR    b) EPDM    c) IIR    d) CR
  - iv) The most delayed action accelerator is  
a) MBT    b) ZDEC    c) DPG    d) DCBS
  - v) The Best air impermeable Polymer is  
a) HNBR    b) ACM    c) IIR    d) EPDM
  - vi) Silicone rubber can be crosslinked by  
a) Sulfur and Accelerator    b) Metal Oxide    c) Peroxide    d) Resin
  - vii) The lowest particle size black is  
a) N774    b) N234    c) N339    d) N110
  - viii) Wood Resin in Rubber Compound is used as  
a) Plasticiser    b) Filler    c) Tackifier    d) Accelerator
  - ix) The best gum strength is observed in case of  
a) NR    b) IIR    c) CIIR    d) CR
  - x) Paraffinic oil is used as plasticizer in which type of rubber

- a) NR    b) IIR    c) SBR    d) BR
- xi) One of the major drawback of Polybutadiene rubber (BR) is  
 a) High Rebound    b) Poor Processability    c) High Tack    d) Green Strength
- xii) Silicone Emulsion is used as  
 a) Reinforcing Agent    b) Mould Release Agent    c) Accelerator    d) Gelling Agent
- xiii) EPDM is  
 a) Monomer    b) Dimer    c) Copolymer    d) Terpolymer
- xiv) RFL dipping is done in textile fabric to improve  
 a) Strength    b) Adhesion    c) Flow    d) Flexibility
- xv) Dry Rubber Content (DRC) in Centrifuged Latex is  
 a) 40%    b) 60%    c) 50%    d) 70%
- xvi) Semi EV Curing gives  
 a) Flexibility    b) Heat Resistance    c) Both Heat Resistance and Flexibility    d) None
- xvii) The ASTM grade for ISAF Black is  
 a) N110    b) N234    c) N330    d) N220
- xviii) The best flame resistant rubber is  
 a) BR    b) IIR    c) NBR    d) CR
- xix) For Stabilisation of field latex the material used is  
 a) NaCl    b) HCl    c) Ammonium Hydroxide    d) Calcium Carbonate
- xx) MC MAX is used in rubber primarily as  
 a) Process aid    b) Antioxidant    c) Antiozonant    d) Activator

**1 x 20 = 20**

- 2) a) What are the different grades of SBRs used in Rubber Industry? Give Examples  
 b) Select the grades of SBR used for Hawaii Chappal and Tyres.  
 c) Give the full form of SIS, SBS, SEBS.  
 d) Give Examples of Rubber – Rubber Blend and Rubber – Plastics Blend. Also give examples. where these blends are used?  
 e) What is Synthetic Polyisoprene (IR)? Give the structure of repeat unit.

**5+(2+2)+3+4+4 = 20**

- 3) a) What are different Furnace Blacks are 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**

4) a) Calculate the Specific Gravity and Cost Per Kg of the following formulation

Material	phr	Specific Gravity	Cost per Kg (RS)
NR	100	0.92	120
ZnO	5	5.57	150
St Acid	2	0.85	70
TMQ	2	1.10	200
HAF	50	1.8	90
Aromatic Oil	10	0.98	60
Sulfur	2.5	2.00	22

b) Mention the most suitable elastomer(s) for the following and give reasons why?

- i) Passenger Car Tyre
- ii) Inner Liner for Tubeless Tyre
- iii) Outer Cover of Petrol Hose
- iv) Oil Seal
- v) Conveyor Belt Cover for Heat Resistance up to 100 Deg C

10+(5 x 2) = 20

### Group B

5) a) What is meant by following terms in case of Textiles?

- i) Denier
- ii) Cord Count
- iii) Tenacity

b) What is twist and how it is important?

c) Select the suitable textile / cord for following rubber products:

- i) Bias Truck Tyre
- ii) Passenger Radial Tyre
- iii) Truck / Bus Radial Tyre
- iv) Cycle Tyre
- v) Aero Tyre
- vi) V Belt
- vii) Conveyor Belt
- viii) Hose
- ix) Tractor Tyre
- x) Racing Tyre

3x2+4+10x1 = 20

6) a) Name the type of filler and vulcanizing agent used for following:

- i) Butyl Tube
- ii) Cycle tyre tread
- iii) Inner Liner for tubeless tyre
- iv) Conveyor Cover for general purpose application
- v) Oil Seal

b) Give at least one example for following:

- i) Vulcanising Agent
- ii) Accelerator
- iii) Antioxidant
- iv) Antiozonant
- v) Retarder
- vi) Scorch Inhibitor
- vii) Peptiser
- viii) Non Reinforcing Filler
- ix) Plasticiser
- x) Tackifier

**5x2+10x1 = 20**

- 7) a) Discuss the structure of chlorosulfonated polyethylene (CSPE) and express the chlorine content and sulphur content in it.
- b) What are the different ways CSPE can be crosslinked? State the mechanism of crosslinking reactions.
- c) Give one name of following accelerators :  
i) Slow ii) Medium Fast iii) Fast iv) Ultra
- d) What do you mean by Eco Friendly Oil? Give Two Examples
- e) For which material Aniline Point and Flash Point are measured. Define in brief the importance of Aniline Point and Flash Point?

**4+4+4x1+2x2+4= 20**

8) Write short notes on any four of the following :

- a) Blowing Agent
- b) Reclaim Rubber
- c) Metal-rubber bonding
- d) Prevulcanised Latex
- e) Latex compounding
- f) Non Black Fillers

**4x5 = 20**