

**INDIAN RUBBER INSTITUTE**  
**DIRI EXAMINATION – 2023**

Paper – II

Date : 9<sup>th</sup> March, 2024  
Duration : 3 Hours

Time : 14.00 – 17.00 hrs.  
Full Marks : 100

**Rubber Processing Technology & Process Engineering**

Answers should be illustrated with sketches wherever helpful  
Total **FIVE** questions are to be answered. **Question number 1** is compulsory.  
• Answer **four** from the remaining questions taking **two** from each group

**GROUP – A**

I. Multiple choice questions: Select the correct answer from the given alternatives:

- (i) 'Frictioning' is associated with  
(a) Injection Molding (b) Transfer molding ~~(c) Calendering~~ (d) Extrusion
- (ii) "Back Pressure" is the terminology used in –  
(a) RIM ~~(b) Extrusion process~~ (c) Compression molding (d) None of the above
- (iii) NR latex is generally stabilized with  
(a) Inorganic acids (b) Organic Acids (c) Strong alkali ~~(d) Ammonia~~
- (iv) The rate of mastication of synthetic rubbers can be increased by:  
(a) Using Oil (b) Antioxidant (c) Antiozonant ~~(d) Chemical Plasticizer~~
- (v) PCI process is associated with the manufacturing of :  
~~(a) Tire~~ (b) Conveyor belts (c) Rubber to metal bonded component (d) None of the above
- (vi) Green strength of an uncured rubber compound is the :  
(a) Ability to show ozone resistance (b) Lack of tack  
(c) Loss of physical properties ~~(d) Ability to maintain stability~~
- (vii) Injection moulding process is also called as \_\_\_\_\_ moulding  
~~(a) Flashless~~ (b) Gateless (c) Runner less (d) Below
- (viii) Dispersion of fillers is the process of  
(a) Increase of aggregate size ~~(c) Decrease of aggregate size~~  
(b) Distribution of fillers (d) Fracture of rubber
- (ix) In an Internal Mixer \_\_\_\_\_ device is used to measure the internal mixing temperature of the compound.  
(a) Thermometer (b) Pyrometer  
~~(c) Thermocouple wire connected to chamber & indicator~~ (d) None of the above
- (x) The unit of pressure is  
(a) Newton ~~(b) Pascal~~ (c) Joule (d) Watt
- (xi) For uniform platen temperature it is recommended to have \_\_\_\_\_ as curing media.  
(a) Steam or Thermic fluid (b) Vapor or Hot air (c) Tempered water ~~(d) Electric heating~~

- (xii) The fill factor in an internal mixer during curative mixing is  
~~(a)~~ 50-55 (b) 60-65 (c) 70-75 ~~(d)~~ 80-85
- (xiii) Porosity in fluidized bed curing is avoided by  
~~(a)~~ use of dessicant (b) application of pressure  
(c) use of dried filler (d) all of a, b and c
- (xiv) Wallace Rapid Plasticity Number illustrates about:  
(a) Scorch time (b) Cure time  
(c) Addition of chemicals ~~(d)~~ Sagging of rubber & lack of adhesion to rolls
- (xv) "Crows feet" can be observed after  
(a) Extrusion (b) Moulding ~~(c)~~ Calendering (d) Mixing on a two-roll mill
- (xvi) On crosslinking the rubber becomes  
(a) Soluble in organic solvents ~~(b)~~ Insoluble in organic solvents  
(c) Partially soluble in organic solvents (d) None of the above.
- (xvii) The pH of NR latex as obtained from the tree is  
(a) 5.5 (b) 6.5 (c) 7.5 ~~(d)~~ 8.5
- (xviii) To test the Mooney viscosity of NR compound at 100°C the pre-heat time required is  
(a) Four minutes (b) Three minutes (c) Two minutes ~~(d)~~ One minute
- (xix) In hot feed extruders, L/D ratio is  
(a) 2:1 ~~(b)~~ 6:1 (c) 15:1 (d) 20:1
- (xx) The recommended friction ratio of open mill for NR compound mixing (Front : Back)  
(a) 1:1 ~~(b)~~ 1:1.25 (c) 1:2.5 (d) 1:5

1 x 20 = 20

2. a) Explain ML 1+4 @ 100 °C for a raw NR polymer testing.  
b) List out the merits & de-merits of MDR vs. ODR.  
c) Write a Rheograph curve of the following & explain:  
- Plateau curve  
- Reversion curve  
- Marching curve  
d) Write a curve of a Mooney viscometer and explain Mooney value and scorch time.

5+5+5+5 = 20

3. (a) Draw a neat sketch of an INTERNAL LMIXER and explain the major parts and its function.  
(b) What are common problem encountered in extruder and their rectification?  
(c) How do ram pressure, temperature and rotor speed affect quality of mixing?

10 + 4 + 6 = 20

4. (a) What are the different components of an internal mixer & discuss their functions?  
(b) How do you establish the optimum batch size of an internal mixer?  
(c) Calculate the batch weight in kgs for a mixer having a net chamber volume of 270 litres, fill factor 75% and a compound of density 1.1 g/c.c

10+5+5 = 20

**GROUP – B**

5. a) What are the different methods of moulding? Compare them with respect to advantage & disadvantages of each.

b) What are the curing process you will adapt to make following produced?

- (i) V belt    (ii) Rubberised cloth    (iii) Moulded hose    (iv) Latex foam    (v) Gumboot  
**(10 + 5 + 5) = 20**

6. (a) Explain the safety factors associated while mixing in a two roll mill with respect to :

- (i) Machine safety    (ii) Human safety  
(b) Discuss the drive system of a two roll mill.  
(c) Show in figures the nip area and the rolling bank of a two roll mixing mill. How it affects the mixing process? Which force is responsible for Front roll to Back roll transfer of the stock? What is up-side down mixing?  
(d) State the functions of different auxiliary chemicals added to the NR latex.

**6+5+5+4= 20**

7. (a) Discuss the operations; Incorporation, plasticization, distributive mixing and dispersive mixing, during compounding of rubber.

(b) Name the process and the product for which following equipment/instrument is required

- (i) Ball mill    (ii) Braider    (iii) Former    (iv) Bago-matic press    (v) Kneader    (vi) Beta scanner  
**(8 + 6x2) = 20**

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

- (a) TCU in a 4 roll calendar  
(b) Microwave curing  
(c) Upside down mixing of EPDM rubber  
(d) Steam heating Vs. Electrical heating system  
(e) Roto-cure  
(f) Mould cleaning method

**4 × 5 = 20**