

**INDIAN RUBBER INSTITUTE  
DIRI EXAMINATION – 2012**

Paper – II

Date : 20<sup>th</sup> July, 2012  
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. From “Group-A” answer **three** questions out of which **Question No. 1** is compulsory and From “Group-B” answer **two** questions only.

**GROUP – A**

1. (A) Multiple choice questions: Select the correct answer from the given alternatives:

- (i) Mastication of rubber is the process of
  - (a) Cutting the bales in smaller pieces
  - (b) Sheeting out the rubber
  - (c) Reducing the viscosity of the rubber
  - (d) Extruding the rubber through a die
  
- (ii) Cambering of calendar rolls are done to
  - (a) Increase the life of the calendar rolls
  - (b) To bring smoothness on the surface of the calendered sheet
  - (c) To maintain uniform gauge of the calendered sheet
  - (d) To reduce thickness of the calendered sheet
  
- (iii) Calender rolls are usually made of:

(a) Alloy steel	(b) Carbon steel
(c) Chilled cast iron	(d) Grey cast iron
  
- (iv) When a three roll calender is used for frictioning, the surface speed of the bottom roll is usually

(a) Equal to the middle roll	(b) Slower than the middle roll
(c) Faster than the middle roll	(d) None of the above
  
- (v) In Mooney Viscometer the rotors are designed as L and S, which stands for :

(a) Long and short	(b) Low and slow
(c) Large and small	(d) None of the above
  
- (vi) Mooney Viscometer is the most effective test for predicting the behaviour rubber compounds during;

(a) Casting	(b) Reaction injection moulding
(c) Compression moulding	(d) Injection moulding

- (vii) Excessive milling of SBR compound may lead to :  
 (a) Softening (b) Gelling  
 (c) High tack (d) None of the above
- (viii) Silicone emulsions are used as:  
 (a) Mould release agent (b) Reinforcing agent in silica filled compound  
 (c) Emulsifying agent in emulsion polymerization (d) None of the above
- (ix) time  $t_2$  from Rheometer curve is related to –  
 (a) Process safety during calendering  
 (b) Process safety during extrusion  
 (c) Mould flow time  
 (d) Time required for mixing.
- (x) High temperature & shorter curing time is preferred for –  
 (a) Thicker moulded articles  
 (b) Thin rubber moulded goods  
 (c) Commonly for all NR products  
 (d) None of the above.
- (xi) Mould shrinkage is directly depending upon:  
 (a) The difference between room temperatures vs. moulding temperature.  
 (b) The moulding pressure  
 (c) The “Bumping” system  
 (d) None of the above.
- (xii) 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
- (xiii) Frictioning is done on one side of the fabric using:  
 (a) 2 – roll calendar of I type  
 (b) 2 – roll calendar of V type  
 (c) 3 – roll calendar of I type  
 (d) 3 – roll calendar of Invented ‘L’ type with difference in roll speed.
- (xiv) Mooney viscometer is used to measure the viscosity of  
 (a) Cured compound  
 (b) Semi cured compound  
 (c) Raw polymer, masticated rubber, master batch & final batch Rubber  
 (d) Porous compound.
- (xv) Typical mill friction ratio for NR compound:  
 (a) 1:1 (b) 1:1.20 (c) 1:2.0 (d) 1:5

(1 x 15) = 15

(B) Indicate if following statements are **true** or **false**

- (i) Peroxide curing generally shows marching modulus.
- (ii) Electrical heated press is preferred over steam heated press as former gives better uniformity in temperature
- (iii) Multiple daylight press is often used for curing of cycle tyre.
- (iv) Both side fractioning is simultaneously can be done using a single 4 bowl calendar.
- (v) Doormat compound needs more scorch safety a tyre tread compound.

(1 x 5) = 5

2.

- (a) Sketch different types of calendar machine and discuss what for they are used.
- (b) How friction ratio & temperature of a calendar machine are controlled.
- (c) Name a few defects encountered during calendaring & their rectification.

(8 + 6 + 6) = 20

3.

- (a) Define following common terms used in rubber industry: i) under cure ii) over cure iii) scorching iv) delayed action v) ultra fast vi) bumping vii) nip gap viii) friction ratio ix) splicing x) liner.
- (b) Draw a typical curve for a rheometer and explain the different terms associated with it.
- (c) Sketch and explain a Mooney curve.

(10 + 5 + 5) = 20

4.

- (a) What is extruder? Show with proper diagram different parts of extruder.
- (b) What is the function of warming will associated with extruder?
- (c) What are common problems encountered in extruder and their rectification?
- (d) Define the following terms
  - i) Single screw 4 double screw extruder.
  - ii) T head and dual head extruder.

(8 + 2 + 4 + 6) = 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. Name the process and the product for which following equipment/instrument is required:

- (a) Braider (b) Ball mill (c) Bago-matic press (d) Triple head extruder (e) Autoclave
- (f) 4 Bowl calendar (g) Roto cure (h) Former (i) Beta-scanner (j) Kneader

(2 x 10) = 20

7. (a) Why compounding ingredients are added to the latex in the form of dispersions or emulsions? Discuss how the dispersions and emulsions are prepared?
- (b) How condom is manufactured? What are the defects one comes across in the manufacture of condoms and how to overcome it? Mention at least one test for condom.
- (c) How pre-vulcanized latex is prepared? Discuss the procedure with a typical formulation?  
**(7+9+4)=20**

8. Write short note on **(any four)**:

- (a) Precautions required during calendaring & extrusion
- (b) Problem of compound scorching
- (c) Mooney Viscometer
- (d) Steam vulcanization of rubber articles
- (e) Spreading operation
- (f) Banbury parts and their functions

**(4x5)=20**