

**INDIAN RUBBER INSTITUTE
PGD-IRI EXAMINATION – 2012**

Paper – II

**Date : 20th July, 2012
Duration : 3 Hours**

**Time : 14.00 – 17.00 hrs.
Full Marks : 100**

Rubber Processing & Engineering

Answer **Question No. 1** and **any four** from the rest taking **two questions** from **each group**. Each question carries 20 marks

Answers should be illustrated with sketches wherever helpful

Part-A

I. Choose the correct answer from the given alternatives

- i) Torque is defined as a product of
 - a) Force and distance
 - b) Force and area
 - c) Pressure and distance
 - d) Pressure and area

- ii) On calendered sheet blisters appear due to
 - a) Roll temperature being too low
 - b) Feed stock temperature being too low
 - c) Roll and/or feed stock temperature being too high
 - d) None of above

- iii) For better dispersion on a mixing mill
 - a) Bank size should be large
 - b) Bank size should be low
 - c) Bank size should be such that material rolls constantly at the nip
 - d) Roll cooling should be enough

- iv) Mould shrinkage increases with increases in
 - a) Rubber content of the compound
 - b) Filler content of the compound
 - c) Moulding pressure
 - d) Viscosity of the compound

- v) During winter, compound surfaces on storage appear to be grey/white due to
 - a) Scorch
 - b) High tack
 - c) Crew's feet
 - d) Blooming

- vi) 'Screw mark' is a phenomenon associated with
 - a) Calendaring operation
 - b) Open-steam vulcanization
 - c) Extrusion
 - d) Press moulding

- vii) 'Honey comb' defect is found in extruded product of
- LPG tube
 - Cycle tube
 - Automotive channel
 - Braided hose
- viii) Continuous vulcanization of an extruded sponge profile can be done by
- Rotocure
 - Microwave cure
 - Fluidized bed cure
 - LCM cure
- ix) When Air trap/Blister are noticed in the Extrudate, it indicates that there is
- Excessive stock feeding
 - Inadequate back-pressure
 - Improper carbon dispersion
 - None of the above
- x) Calenders are designated by
- The number of rolls and geometrical configuration
 - Gauge of the calendered sheet
 - Roll length
 - Total height of the structure
- xi) For thick compression molded articles, it is recommended to
- Adopt a high temperature short curing cycle
 - High temperature long curing cycle
 - Lower temperature longer cure time
 - Usage of an ultra accelerator
- xii) Post cure inflation of tyres is mandatory for the following types of tyres
- Polyester
 - Nylon
 - Steel
 - Rayon
- xiii) Scorching of rubber compounds is mainly caused by
- Excessive oil dosage
 - Slow curing accelerators
 - Excessive processing temperature
 - Improper black dispersion
- xiv) The term marching modulus refers to
- Drop in elongation characteristics
 - Loss in tensile strength
 - An increase in modulus
 - Loss in abrasion properties
- xv) Excessive remilling of SBR compound may lead to
- Softening
 - Gelling
 - High tack
 - None of the above
- xvi) Butyl rubber is generally compounded at higher temperature than NR due to its relatively
- Low level of un saturation
 - High unsaturation
 - Low Mooney Viscosity
 - None of the above

xvii) Blooming is a phenomenon where

- a) Processability of a rubber compound is affected
- b) Proper distribution of compound ingredients hampered
- c) Blisters appear on the surface of compound
- d) Compounding ingredients migrate from bulk to the surface of a rubber compound

xviii) The fill factor in an internal mixture during curative mixing is

- a) 50 - 55
- b) 60 - 65
- c) 70-75
- d) 80 - 85

xix) Porosity in fluidized bed curing is avoided by

- a) Use of desiccant
- b) Application of pressure
- c) Use of dried filler
- d) All of a, band c

xx) A high value of die swell indicates

- a) Low viscosity
- b) High viscosity
- c) Low elasticity
- d) High elasticity

20 x 1 = 20

2. a) What are essential features of an injection molding? How does it differ from RIM?
b) Illustrate two methods of continuous vulcanization -fluid bed and eutectic salt bath method.
Discuss the difference between the two.
c) What are the different techniques used for mold cleaning

$((5+3) + (6+2) + 4) = 20$

3. a) Explain with specific example the calculation procedure of Banbury batch volume.
b) Explain the terms i) Two pass mixing ii) Upside down mixing iii) Late oil addition technique

$(8+4 \times 3) = 20$

4.

- a) Sketch and explain various roll arrangements of calender.
- b) Explain the spreading operation with the diagram.
- c) Explain the reason for the following calendaring problem i) Stock blister ii) Scorching iii) Variable gauge
- d) How temperature control is carried out in a calender.

$(5+5+6+4) = 20$

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Part-B

5. a) Compare hot feed and cold feed extruder with respect to design feature, application and output rates.
b) What is a dual extruder? Give example where dual extruder is used?
c) Trouble is being experienced through scorch during extrusion. How would you ascertain whether the trouble is due to i) compound ii) extruder iii) warming mill
d) The volumetric flow rate of an extruder depends on drag flow, pressure flow and leakage flow. Explain each term and their dependence on various factors.

(6+4+6+4) = 20

6. a) What are different types of cure curves obtained from Rheometric study? Explain with sketch.
b) Sketch and explain a Mooney curve. What is ML_{1+4} @100°C?
c) Explain the working principle of a shearing Disc viscometer.
d) Describe the significance of plasticity with respect to processing characteristics.

[5+ (4+1)+6+4] = 20

7. a) Suggest a loading and mixing sequence for a typical black loaded tread compound.
b) Describe drive systems for a simple two roll mill.
c) How is cooling of the mill roll effectively carried out?
d) What are the precautions to be taken in a two roll mixing mill with respect to i) machine safety and ii) operator safety.

(6+5+5+4) = 20

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

- a) Electron beam curing
b) Steam vs. Electrical heating system
c) Hot air tunnel method of curing
d) Deflashing
e) Salvaging of partially scorched compounds

(5 x 4) = 20