INDIAN RUBBER INSTITUTE
DIRI EXAMINATION – 2022

Paper – II

Date : 25th March, 2013   Time : 14.00 – 17.00 hrs.
Duration : 3 Hours   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

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

   (i)   The unit of pressure is
          (a) Newton   (b) Pascal   (c) Joule   (d) Watt

   (ii)   Screw mark is associated with:
          (a) Calendering   (b) Open steam cure   (c) Extrusion   (d) Press moulding

   (iii) The "bagginess" is common problem while mixing _____ compound.
          (a) NR   (b) CR   (c) SBR   (d) BR

   (iv)   The Rheograph of SBR based rubber compound will show:
          (a) Plateau curve   (b) Marching Modulus curve
          (c) Reversion curve   (d) Straight line.

   (v)   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

   (vi)   The mold temperature in an injection moulding machine is:
          (a) Higher than injection temperature,   (c) Lower than injection temperature
          (b) Equal to injection temperature   (d) None of the above

   (vii) Bag-O-matic presses are used for vulcanizing –
          (a) Tube   (b) Tyre   (c) V-belt   (d) Cable

   (viii) 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.

   (ix)   Scorching of rubber compounds takes place due to:
          (a) Excessive oil dosage   (b) Slow curing accelerators
          (c) Excessive processing temperature (d) Improper black dispersion

   (x)   The pH of NR latex as obtained from the tree is
          (a) 5.5   (b) 6.5   (c) 7.5   (d) 8.5

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(xi) ML 1+8 @ 125° C is related to
   (a) NR   (b) BR   (c) SBR   (d) IIR

(xii) Optimum cure time of compound is generally obtained by using
   (a) Mooney viscometer   (b) Tripsometer   (c) Rheometer   (d) Plastometer.

(xiii) "Back Pressure" is the terminology used in
   (a) RIM   (b) Extrusion process   (c) Compression molding   (d) None of the above

(xiv) For achieving the uniform thickness of compound during calendaring simultaneous both side:
   (a) Calender speed.   (b) Calender roll dimension is the only reason
   (c) The roll temperatures of calendar nip is very critical   (d) None of the above.

(xv) 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

(xvi) Mastication will be favoured in the presence of:
   (a) Peptizers   (b) Antioxidants   (c) Antiozonant   (d) None of the above

(xvii) Mooney Viscometer is the most effective test for predicting the behavior rubber compounds during:
   (a) Casting   (b) Reaction injection moulding
   (c) Compression moulding   (d) Injection moulding

(xviii) In a hydraulic curing _____ process needs to be done to remove entrapped air of a rubber product
   (a) Frictioning   (b) Prickling   (c) Awling   (d) Bumping

(xix) During the coating of both the sides of textile in a 4-roll calendar the second & third roll runs in _____ speed.
   (a) Uneven   (b) Even   (c) 1:1.1   (d) 1:1.15

(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

$(1 \times 20) = 20$

2.
(a) Sketch different types of calender machine and discuss what for they used.
(b) How friction ratio & temperature of the calender machine are controlled?
(c) Discuss the following operations in a calender machine: (i) frictioning (ii) topping and (iii) sheeting.
(d) What are the defects comes across during calendering operation and the ways to tackle them?

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

3.
(a) Write the basic differences between hot feed & cold feed extruders.
(b) Discuss any two problems observed in extrusion and give remedial solution
(c) Write a neat sketch of standard rubber hot feed extruders and explain its different parts
(d) What is die swell? How it can be controlled?

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

4. (a) List out the merits & de-merits of MDR vs. ODR.
   (b) Write a curve of a mooney viscometer and explain mooney value and scorch time.
   (c) A fabric is 0.09 mm thick. It is proofed on both sides with rubber compound of sp.gr. 1.250. Determine the weight of the proofing one square meter fabric to give overall thickness of 0.60 mm. Assume no penetration of the fabric occurred by the compound (10 marks).

   $(5 + 5 + 10) = 20$

GROUP – B

5. (a) Explain platen heating versus dome heating system for tyre curing
   (b) Explain the salient feature of a liquid curing method of vulcanization.
   (c) What are the various techniques followed for 'Mould cleaning' operation & explain them briefly.
   (d) Compare the merits and demerits of Stream curing and Electrical heating curing

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

6. (a) Explain with neat sketches (i) Screw Injection moulding and (ii) screw – ram injection moulding machines.
   b) Explain merits and demerits of compression moulding method.
   c) What are the factors which contributes to "Mould shrinkage" of rubber and explain.

   $(10 + 5 + 5 = 20)$

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 prevulcanized latex is prepared? Discuss the procedure with a typical formulation.

   $(5+5) + (5+5) = 20$

8. Write short notes on (any four).
   (a) Mould release agent
   (b) Safety methods used in mixing and extrusion
   (c) Die Swell
   (d) Upside down mixing of EPDM rubber
   (e) Mastication
   (f) Spreading operation of fabric.

   $(4 \times 5) = 20$

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