INDIAN RUBBER INSTITUTE
DIRI EXAMINATION – 2011

Paper – II

Date : 29th June, 2011 **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
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) To convert lbs/ sq. in to Kg/cm^2 multiply by
(a) 0.10 (b) 0.01
(c) 0.07 (d) 0.09

(iii) Blooming on the rubber surface occurs, when
(a) Mixing of the ingredients in rubber is inhomogeneous
(b) Rubber has low tack property
(c) Migration of excess solid particles due to incompatibility
(d) None of the above

(iv) Mastication efficiency of NR on the mixing mill is lowest in the temperature range
(a) $25 – 55^0C$ (b) $60 – 95^0C$
(c) $100 – 120^0C$ (d) $130 – 140^0C$

(v) "Roller die" consists of combinations of;
(a) A two roll calender with internal mixer feeding
(b) A two roll calender with open mill feeding
(c) A three roll vertical calender with a two-roll calender feeding
(d) A two roll calender with extruder feeding

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

(vii) On mastication, molecular weight of the rubber
(a) Increases (b) Decreases
(c) Remains unchanged (d) None of the above

(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) On incorporation of carbon black into rubber
(a) Hardness increases (b) Hardness decreases
(c) Hardness does not change (d) Becomes brittle

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

(xi) In a cold feed extruder, the extrudate temperature increases as
(a) The Mooney viscosity of the compound decreases
(b) The screw temperature increases
(c) The screw speed increases
(d) None of the above

(xii) Both the sides coating of a fabric can be simultaneously done by using
(a) Z-type 4 roll calendar
(b) Inverted 'L' type 3 roll calendar
(c) L type 3 roll calendar
(d) None of the above

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

(xiv) After the moulding the O-ring dimensions will measure
(a) Lesser than mould dimension
(b) Higher than mould dimension
(c) Equal to mould dimension
(d) No effect

(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) Reversion & OCT can be tested by using –
(a) Mooney viscometer (b) MDR
(c) Resiliometer (d) DIN abrader

(xvii) Volume x Specific gravity x Fill factor is equal to –
(a) Bulk volume rate (b) Batch weight
(c) Volume liter (d) Bulk viscosity.

(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) Autoclave steam curing presses are recommended for curing _____ articles.
(a) Tyres (b) Tubes (c) Textile rollers (d) O-rings

(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) Write down minimum 5 advantages in compression moulding.
(b) Write down two major disadvantages in transfer moulding.
(c) What are the three major advantages in Injection moulding?
(d) Write down recommended moulding temperature in compression, transfer and injection moulding.

(5 + 5 + 5 + 5) = 20

3.
(a) Write a neat sketch of an INTERNAL LMIXER and explain the major parts and its function.
(b) A Banbury is used for mixing 100 parts NR compound with the rotor rpm of 20 with batch weight of 200 kgs. If the specific gravity of compound is 1.10 calculate the volume of the chamber (assume fill factor as 0.75).
(c) Write with neat sketch, the use of T C U in an internal mixer.

(10 + 5 + 5) = 20

4.
(a) How temperature of the calender rolls are controlled? What are the media used to heat and cool the roll?
(b) Discuss the following operations in a calender machine: (i) frictioning (ii) topping and (iii) sheeting.
(c) What are the defects one comes across during calendering operation and the ways to tackle them?

(6 + 8 + 6) = 20

GROUP – B

5.
(a) Compare & explain the Hot feed extruder and cold feed extruder.
(b) What is DIE – SWELL and explain the various factors effecting die swell.
(c) If a circular article is extruded in a cold feed extruder at 85° C of Extrusion temperature, which attains the final dia of 10 mm at the end of extrusion, calculate the % die swell if the dia of original die is 8 mm.

(10 + 5 + 5) = 20

6.

(a) 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? Write down the sequence of mixing of additives to rubber and explain why?

(b) Discuss the operations; Incorporation, particle size reduction, distributive mixing and dispersive mixing, during compounding of rubber.

(c) State the functions of different auxiliary chemicals added to the NR latex.

(8 + 8 + 4) = 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) Which method of dipping is adopted in the manufacture of condoms? How it is vulcanized? What are the defects one comes across in the manufacture of condoms and how to overcome it?

(c) How prevulcanized latex is prepared? Discuss the procedure with a typical formulation.

(1+6) + (4+2+3) + 4 = 20

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

(a) Mold Shrinkage

(b) Safety methods used in mixing and extrusion

(c) Bag – O – Matic curing press

(d) Roll bending and Roll cambering

(e) PD and PID controller

(f) Heating and cooling system in calenders

(4 × 5) = 20