INDIAN RUBBER INSTITUTE
DIRI EXAMINATION – 2018

Paper – III

Date : 15th July, 2018 | **Time : 10.00 – 13.00 hrs.**
Duration : 3 Hours | **Full Marks : 100**

Rubber Materials, Rubber Compounding and Reinforcement

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) Which polymer swells the least when immersed in petrol?
(a) BR (b) EPDM (c) SBR (d) CSM

(ii) Which of the following rubbers possesses highest self protection against ozone?
(a) CR (b) NBR (c) SBR (d) EPDM

(iii) Which of these blends would make a thermoplastic elastomer?
(a) PP-EPDM (b) PP-PVC (c) LDPE-ABS (d) NR-BR

(iv) Which of these rubbers has best low temperature flexibility?
(a) SBR (b) ECO (c) MVQ (d) FKM

(v) Which of these accelerators has maximum delaying action?
(a) MBT (b) CBS (c) ZDC (d) MBTS

(vi) Dry rubber content of centrifuged natural latex is approximately
(a) 60% (b) 50% (c) 70% (d) 45%

(vii) Dicumyl Peroxide (DCP) is used as
(a) Peptiser (b) Cross Linking Agent (c) Accelerator (d) None of the above

(viii) Dry bonding agent used for textile-rubber bonded product is:
(a) Chemlok (b) Isocyanate (c) Brass (d) Hexa + Resorcinol

(ix) The unit of tenacity of a filament is:
a) Tex b) Denier c) g/Denier c) Pa

(x) ZDC is used as an accelerator in:?
a) Latex Products b) Tennis Ball c) Footwear d) Power transmission belts

(xi) Which rubber provides maximum abrasion resistance?
(a) NR (b) SBR (c) BR (d) PU

(xii) Which polymer exhibits maximum heat resistance properties?
(a) CR (b) NBR (c) EVA (d) IIR

(xiii) Which one is the heaviest filler in rubber compounds?
(a) Carbon black (b) China clay (c) Silica (d) Barytes

(xiv) Most suitable elastomer for steam hose :
(a) Silicone (b) Butyl (c) Polybutadiene (d) EPDM

(xv) The term 'Mechanical Stability Time' is associated with :
(a) Aaromatic oils (b) NR latex (c) Oil-extended polymers (d) None of above

(xvi) Which of these polymers shows lowest tackiness?
(a) NR (b) EPDM (c) NBR (d) SBR

(xvii) Identify the flame retardant filler
(a) Calcium carbonate (b) Hard clay
(c) Aluminium trihydrate (d) High abrasion furnace black

(xviii) What is the basis of grading ISNR?
(a) Viscosity (b) Ash content (c) Dirt content (d) Cure rate

(xix) Which of these rubbers has maximum air impermeability?
(a) CR (b) CPE (c) Hypalon (d) IIR

(xx) Paraffinic oil is most suitable plasticizer for :
(a) NBR (b) SBR (c) Flouroelastomers (d) EPDM

(1 x 20) = 20

2. (a) Give different classifications of Natural Rubber.
(b) What is Guttapercha? What is different between Guttapercha and Natural rubber based the structure of its repeat unit and properties?
(c) What is Initial Plasticity Number and Plasticity Retention Index? Explain the significance of both terms with regards to Natural Rubber.
(d) What will be the impact if Nitrogen and dirt content is increased in NR or NR compound?

(6+5+5+4) =20

3. (a) What are the various types of furnace blacks now available?
(b) Arrange these grades in order of increasing surface area.
(c) Explain in short the following terms in carbon black
(i) Particle size (ii) Structure (iii) Ash content (iv) pH
(d) What properties will improve due to addition of carbon black to rubber compound?

(6+3+4+7) = 20

4. (a) What do you mean by technologically compatible blend? Give an example of miscible rubber-plastic blend.
   (b) Select suitable rubber/rubber blends to the following application giving reasons for the same
   (i) Inner liner for tubeless tyre (ii) Tyre curing bag (iii) High voltage cable insulator (iv) Aerotyre (v) Shoe soles
   (a) Select a suitable curing agent for your suggested rubber/rubber blends to above mentioned products.

(5+5x2+5) = 20

GROUP – B

5. (a) What do you mean by CV, Semi-EV and EV system of curing as applied to NR compounding? How its effect on properties, like weather or heat resistance and flexibility?
   (b) Name few important non-black fillers.
   (c) Give one example of each of the following :
   i) anti-oxidant, ii) ultra-fast accelerator iii) vulcanization activator iv) peptizer v) extender vi) blowing agent vii) tackifier viii) post vulcanization stabilizer ix) retarder x) eco-friendly oil.

(7+3+10) = 20

6. (a) Describe how reclaim rubber is produced from scrap tyres with special reference to either Reclamator process or Digestive process. Explain with figures whatever necessary
   (b) What are the advantages and disadvantages of reclaim rubber vis-à-vis crumb rubber. Discuss with respect to two formulations using reclaim rubber and/or crumb rubbers.
   (c) What are antistatic agents? Name two of them. How they function?

(8+8+4) = 20

7. (a) Design a compound for a typical oil seal for industrial application.
   (b) Give reasons for the choice of polymer and ingredients for the same oil seal.
   (c) What is ASTM Oil No. 3?
   (c) What is reversion?
   (b) Select grade of Natural Rubber for truck tyre and cycle tyre.

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

8. Write short notes on: (**any <u>four</u>**):
   (a) Flame retardants
   (b) Silica based reinforcing filler
   (c) Different textile materials used in rubber industry.
   (d) Factices
   (e) Blowing agent
   (f) Non-staining antioxidants

(4 x 5) = 20