

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3152601

Date: 25/05/2026

Subject Name: Vulcanization

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) Define the term vulcanization and state its practical significance in rubber technology. **03**
 - (b) Analyse how excessive vulcanization (over-curing) can degrade mechanical properties by altering the nature of sulphur crosslinks. **04**
 - (c) Explain effect of temperature, thickness, and thermal stability on the state of cure and uniformity in thick rubber articles. **07**
- Q.2**
- (a) Brief out the term insoluble sulphur and also give its industrial importance. **03**
 - (b) Apply your understanding of vulcanization chemistry to compare the curing behaviour of NR, SBR, and NBR. **04**
 - (c) Explain the differences in properties between unvulcanized and vulcanized rubber. Correlate these differences with molecular structure. **07**
- OR
- Q.2**
- (c) Explain the mechanism of vulcanization using sulfur and accelerators. Show how crosslinking modifies the rubber network structure. **07**
- Q.3**
- (a) Define term accelerator and mention its role in vulcanization along with its classification. **03**
 - (b) Apply the concept of rubber reactivity to explain why peroxide vulcanization is preferred over sulfur curing for saturated rubbers such as EPDM rubber, EPM, and FKM rubber. **04**
 - (c) Explain the effect of crosslink type on tensile strength, modulus and compression set of rubber vulcanizate. **07**
- OR
- Q.3**
- (a) Name two commonly used sulfenamide accelerators with their structure. **03**
 - (b) Identify how coagents improve crosslinking efficiency and mechanical properties in peroxide-cured elastomers. **04**
 - (c) Explain the effect of crosslink type on abrasion resistance, heat stability and fatigue resistance of rubber vulcanizate. **07**
- Q.4**
- (a) State the difference between chemical and physical crosslinks. **03**
 - (b) Suggest a suitable vulcanization technique for thin rubber sheets and justify reason for choosing that particular technique. **04**

- (c) Explain rotocure vulcanization process with labeled diagram with it's construction, working and typical applications. **07**

OR

- Q.4** (a) List the factors responsible for mould shrinkage of any rubber product. **03**
(b) Compare hot air vulcanization technique with steam vulcanization technique. **04**
(c) Explain in detail the fluidized bed vulcanization technique with inclusion of it's principle, process, advantages, and limitations. **07**

- Q.5** (a) What do you mean by moisture curing? **03**
(b) Compare chemical and physical methods used for evaluating the state of vulcanization. **04**
(c) Explain construction and working of Oscillating Disc Rheometer (ODR) and interpret a typical cure curve. **07**

OR

- Q.5** (a) What do you mean by batch vulcanization techniques? Also give it's examples. **03**
(b) Analyse why controlled cure time is important to prevent under-cure and reversion in any rubber article? **04**
(c) Explain role of arrhenius equation to predict cure characteristics and optimize vulcanization in rubber industrial operation. **07**
