# BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, PILANI

First Semester 2023 – 2024

CE G549 (Rural Roads Technology) Comprehensive (Closed Book)

Instructor In-Charge : Dr. Nishant Bhargava

Max. Marks : 70   **Duration : 3 hours**

1. Draw a typical plan of formwork of plastic cells (with dimensions) in cell filled concrete pavement. **[3]**

2. Draw a typical cross section of a rural road with application of jute geotextile. **[3]**

3. Explain the need for construction of trial length in a cement concrete pavement. List the construction considerations and tests to be conducted on the trial length section. **[6]**

4. List the functions of field, district and central laboratory in quality control. **[6]**

5. Explain the process for repair of shallow and deep potholes in a flexible pavement. **[6]**

6. List the advantages and limitations of microsurfacing treatment. **[6]**

7. Explain in detail the construction process of OGPC using bitumen emulsion. **[10]**

8. What are the three tiers in the quality management mechanism for rural roads? Explain the functions of each tier in quality control. **[10]**

9. 24-hour traffic counts over a period of 3 days taken on a single lane rural road during the lean non-harvesting season. The average daily traffic results are:

Animal-drawn carts (Pneumatic-Tyred)	*20*
Bicycles	*290*
Full-sized trucks	*10*
Agricultural Tractor-Trailers and Jugads	*50*
Cars and Jeeps	*30*

There are two harvesting seasons in the area, each having a duration of 2 months, the harvesting season traffic remaining at its peak for 12 days. The above traffic count data was collected 3 years before opening the road to traffic. Assuming that the traffic in peak harvesting season is 3 times the traffic in non-harvesting season, compute the cumulative ESAL application. Use VDF as 2.86, 0.31, 0.34 and 0.02 for HCV laden, HCV unladen, MCV laden and MCV unladen respectively. Assume all the other design values as per IRC SP 72 (2015). **[10]**

10. Cement concrete pavements are to be designed for Rural Roads in Bihar having traffic volume of 100 CVPD (temperature differential for 175 mm slab thickness = 16°C). Soaked CBR of subgrade soil = 5% and corresponding modulus of subgrade reaction is 42 MPa/m. Adopt 28-day compressive strength of 30 MPa. Provide 150 mm WBM-III over 100 mm GSB. Determine whether the design is safe for slab thickness of 175 mm and joint spacing of 3 m. Assume all the other design values as per IRC SP 62 (2014). **[10]**
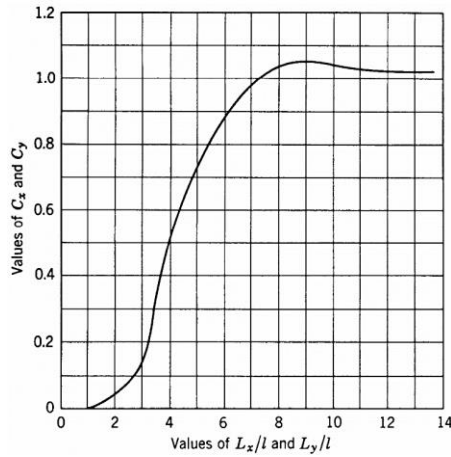
$$\sigma_e = \frac{0.803\,P}{h^2}\left[4\,log\left(\frac{l}{a}\right) + 0.666\left(\frac{a}{l}\right) - 0.034\right]$$

$$l = \left[\frac{E\,h^3}{12\,K\,(1-\mu^2)}\right]^{1/4}$$

$$\sigma_{te} = \frac{E\alpha t}{2}\,C$$

$$a = \sqrt{\frac{0.8521\,P_d}{q\,\pi} + \frac{S_d}{\pi}\sqrt{\frac{P_d}{0.5227\,q}}}$$