**TQ4**

**1. A signal is sampled at 100 samples/sec. It was later found that the original signal**

**contained a frequency component at 60 Hz. Calculate the frequency at which the aliasing effect is seen in the power spectrum in the frequency range [0 50] Hz.**

**2. The stiffness, *k*, of a linear spring used for vibration damping is 120 lbf/inch. Calculate**

**the resisting force on the spring for a deflection of 0.2 inch.**

**3. The drive gear in a gearbox has 32 teeth. It drives a pinion with 16 teeth. The drive**

**shaft speed is 180 RPM. Calculate the following.**

**(a) Drive gear shaft speed (Hz)**

**(a) Tooth mesh frequency (Hz)**

**(c) Rotational speed of the pinion (Hz)**

**4. Calculate the belt pass frequency for a belt drive, with a total belt length of 200 inch.**

**The belt passes over a pulley of diameter 20 inch with a shaft frequency of 1000**

**RPM. Express your answer in cycles per minute.**

**5. The ball pass frequency of the outer race (BPFO) in a ball bearing is given by**



**The following parameters are given: Bd = 8 mm, Pd = 40 mm, θ = 0°.**

**(a) Simplify the expression for BPFO in terms of Nb and fr.**

**(b) If Nb = 9 and fr = 30 Hz, calculate the BPFO for this bearing.**

**(c) What does BPFO indicate if there is a defect in the bearing outer race?**