

OPEN BOOK EXAMINATION --- Textbooks, notes and assignments are permitted.

1. Select a "V" belt drive to transmit 20hp. from a one cylinder gasoline engine running at 450 rpm to a rock crusher. The instantaneous loads are in the order of 40 horsepower. The rock crusher has a flywheel that removes approximately 50% of the peak crushing loads.
2. Select a roller chain drive that will carry power from a 3 hp. low starting torque electric motor to a ventilation fan. It is expected that the fan will run continuously for at least 10 years.
3. Explain why a structural member subject to impact loads would be severely compromised by stress concentrations. For the devices shown below, indicate how the effects of the stress concentrations can be mitigated. Also indicate how effective these mitigating systems would be at reducing the damage due to shock loading. Give examples.
4. Wire rope can be used to carry tension loads. Wire rope is known to fail due to two factors. State what these factors are. Design a wire rope system to transfer energy from a slow turning spool 50cm in diameter over a pulley (150 degrees wrap) the object being to lift 2000 kg placed in a 500kg skip. The peak acceleration being 2.0 meters per second per second. The wire rope should last at least 20,000 up down cycles. The weight being lowered on the skip would never exceed 400 kg.
5. An engine is to provide 200hp at 1500 rpm. It is to be connected to a 300 rpm pump. Design the connecting drive assuming the spacing is 20 feet.
6. Design a weld to fasten a $\frac{1}{2}$ inch thick bar that is 4 feet long and six inches wide to a girder that is 8 inches wide and $\frac{1}{2}$ inch thick. Assume that you are using E60xx rod and good welding practices are followed. Show clearly how the load is applied and state what surface preparation is necessary.