

# ECE471 INDUSTRIAL POWER SYSTEMS

## Assignment # 2

1. Design the feeder for MCC1 on the class example, i.e. specify the cable and conduit size. The loads on the feeder are: 76 kVA @ 0.8 lag, plus 30 hp, 5 hp, and 50 hp motors each 0.8 lag and 80% efficiency. All loads are 480 V, 3 $\phi$ .
2. Design the feeder for MCC2 on the class example, i.e. specify the cable and conduit size. The loads on the feeder are: 99 kVA @ 0.8 lag, plus 2 hp, 5 hp, 30 hp and 100 hp motors each 0.8 lag and 80% efficiency. All loads are 480 V, 3 $\phi$ .

NOTES: Base the designs on ampacity only to size the conductor, using THWN copper, and use table 11.6 to size the conduit. Assume the conduit will be used for grounding the system, so a ground wire is not required. If you cannot find the correct size of conduit in table 11.6, use the table on the next page, which is taken from the NEC.

3. Specify the cable and conduit size for the following feeder (you may need to consider paralleling conductors.)
  - Continuous load is 268 kW @ 0.9 lag pf.
  - More than 50% of the load produces significant 3<sup>rd</sup> harmonics.
  - Supply is 480 V, three-phase, four-wire.
  - Feeder length is 235 ft.
  - Available fault current is 39 kA, symmetrical.
  - Feeder overcurrent protection is molded-case CB.
  - Maximum allowable voltage regulation is 2%.
  - Conductors are XHHW (90<sup>o</sup>C) copper in steel conduit.

Show all calculations needed to satisfy all 3 criteria for specifying the feeder.

**Table 3A. Maximum Number of Conductors in Trade Sizes of Conduit or Tubing**  
(Based on Table 1, Chapter 9)

Conduit Trade Size (inches)		1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6
Type Letters	Conductor Size AWG, kcmil												
TW, XHHW (14 through 8)	14	9	15	25	44	60	99	142					
	12	7	12	19	35	47	78	111	171				
	10	5	9	15	26	36	60	85	131	176			
	8	2	4	7	12	17	28	40	62	84	108		
RHW and RHH (without outer covering), THW	14	6	10	16	29	40	65	93	143	192			
	12	4	8	13	24	32	53	76	117	157			
	10	4	6	11	19	26	43	61	95	127	163		
	8	1	3	5	10	13	22	32	49	66	85	133	
TW,	6	1	2	4	7	10	16	23	36	48	62	97	141
	4	1	1	3	5	7	12	17	27	36	47	73	106
THW,	3	1	1	2	4	6	10	15	23	31	40	63	91
	2	1	1	2	4	5	9	13	20	27	34	54	78
	1	1	1	1	3	4	6	9	14	19	25	39	57
FEPB (6 through 2), RHW and RHH (with- out outer covering)	1/0		1	1	2	3	5	8	12	16	21	33	49
	2/0		1	1	1	3	5	7	10	14	18	29	41
	3/0		1	1	1	2	4	6	9	12	15	24	35
	4/0		1	1	1	1	3	5	7	10	13	20	29
250 300 350 400 500				1	1	1	2	4	6	8	10	16	23
				1	1	1	2	3	5	7	9	14	20
				1	1	1	1	3	4	6	8	12	18
				1	1	1	1	2	4	5	7	11	16
				1	1	1	1	1	3	4	6	9	14
600 700 750					1	1	1	1	3	4	5	7	11
					1	1	1	1	2	3	4	7	10
					1	1	1	1	2	3	4	6	9

Note: This table is for concentric stranded conductors only. For cables with compact conductors, the dimensions in Table 5A shall be used.