ME6315 ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION TEST II

Max. Marks: 10+10=20 **Time: 1 Hour**

Use separate answer sheets for Part A and B

Part A

1. The displacement in mm of the tip of an aircraft wing is represented by the equation $y = 50\sin 100\pi t + 5\cos\left(1200\pi t - \frac{\pi}{6}\right) - \sin\left(24000\pi t + \frac{\pi}{4}\right)$, where t is in seconds. Determine the fundamental frequency in Hz and period in seconds. What harmonics are present?

(3 marks)

2. One cycle of the pressure in an engine cylinder was sampled at equal intervals of time with results: 600, 842, 924, 884, 800, 742, 724, 700, 600, 383, 76, -225, -400, -366, -124, 241. Express the data in the form of a Fourier series. Neglect frequencies greater than twice the fundamental frequency.

(5 marks)

3. A 10Hz signal is sampled at a) 12Hz b) 18Hz c) 24Hz d) 30Hz. What will be the frequency of the sampled signal?

(2 marks)

SOLUTIONS

1) f=50Hz, T=0.02s. 12th and 240th harmonics are present.

2)

θ	y	ysin θ	ycos θ	ysin 2θ	ycos 2θ
0	600.00	0.00	600.00	0.00	600.00
0.392699	842.00	322.22	777.91	595.38	595.38
0.785398	924.00	653.37	653.37	924.00	0.00
1.178097	884.00	816.71	338.29	625.08	-625.08
1.570796	800.00	800.00	0.00	0.00	-800.00
1.963495	742.00	685.52	-283.95	-524.67	-524.67
2.356194	724.00	511.95	-511.95	-724.00	0.00
2.748894	700.00	267.88	-646.72	-494.97	494.97
3.141593	600.00	0.00	-600.00	0.00	600.00
3.534292	383.00	-146.57	-353.85	270.82	270.82
3.926991	76.00	-53.74	-53.74	76.00	0.00
4.31969	-225.00	207.87	86.10	-159.10	159.10
4.712389	-400.00	400.00	0.00	0.00	400.00
5.105088	-366.00	338.14	-140.06	258.80	258.80
5.497787	-124.00	87.68	-87.68	124.00	0.00
5.890486	241.00	-92.23	222.65	-170.41	170.41
Average	400.06	299.92	0.02	50.06	99.98

$y=400+600\sin\theta+100\sin 2\theta+200\cos 2\theta$

3) 2Hz, 8Hz, 10Hz, 10Hz.