MANIPAL INSTITUTE OF TECHNOLOGY Manipal University

Reg. No.

SECOND SEMESTER M.Tech. (ASE) DEGREE END SEMESTER EXAMINATION May/June 2016 SUBJECT: ASTRONOMICAL INSTRUMENTATION (ICE - 584)

TIME: 3 HOURS MAX

Instructions to candidates Answer ANY FIVE full questions.

- Missing data may be suitably assumed.
- 1A. Draw a neat and labelled diagram of Reflecting Telescope and Refracting telescope. List out the advantage and disadvantages of both.
- 1B. Explain the charge read out process of CCD sensor charge with the help of bucket-model.
- 1C. Briefly explain the Croma and Astimagtism defects in Convex lenses.
- 2A. Define the following terms
 - (i) Magnifying power of a telescope (ii) Dark Current of CCD Sensor
 - (iii) Astrometry and photometry (iv) Irradiance and Emittance.
- 2B. Explain the working of Photomultiplier tube with a neat diagram.
- 2C. Describe the stellar paradox in short.

3A. With schematic diagram explain the role of piezoelectric crystals in Force measurement. Show that the voltage developed across two opposite faces of a crystal is equal to F= g p t where, g=charge sensitivity, p= pressure, t= thickness

State the relation between charge sensitivity and voltage sensitivity

- 3B. Briefly describe the operation of gyroscope with a neat diagram.
- 3C. What is an interferometer? Briefly explain its principle of operation.

- 4A. What is Coronagraph ? Draw a neat diagram for(i) Internally occulted refracting coronagraph(ii) Externally occulted refracting coronagraph
- 4B. Telescope A and Telescope B have primary lenses of diameter of 6cm and 30cm respectively. Focal length of telescope A is 60cm and telescope B is 140cm. Compare the light gathering capacity and magnifying power of Telescope A and Telescope B.

4C. A disk of 5 kg mass with radius of gyration of 70mm is mounted at a span on a shaft that spins at 720rpm in anti-clockwise direction as shown in Fig 4(C), if the shaft rotates about the vertical axis at 30 rpm in anti-clockwise direction when viewed from the top. Determine the gyroscopic couple developed.

(4+3+3)



(4+4+2)

(4+3+3)

(4+4+2)

MAX. MARKS: 50





Fig Q 5(a)

- 5A. (i) Discuss the Doppler effect and Doppler shift.
 - (ii) Taking the speed of sound as 3.40x102 m/s consider the following six situations
 - (a) Receiver moves towards stationary source with velocity of 170 m/s
 - (b) Receiver moves away from stationary source with velocity of 170 m/s
 - (c) Source moves towards stationary Receiver with velocity of 170 m/s
 - (d) Source moves away stationary Receiver with velocity of 170 m/s
 - (e) Receiver and source both moves away from each other with velocity of 170 m/s
 - (f) Receiver and source both moves towards each other with velocity of 170 $\mbox{m/s}$

If the source emits sound wave of frequency 3.00x102 m/s then determine the frequency of the receiver detects in each case.

5B. Capacitive transducers using 2 plates is shown in figure 5.1 The dimension of each plate is 30mm*30mm and the distance between the plates is d=20mm. find the effective capacitance of a transducer across the terminal a and b,

(Assume dielectric medium k=25*10-9 F/m and k0=8.85*10-12 F/m)

5C A CCD sensor with specification 2K x 1K and has physical dimensions as 40mm X 20mm then calculate the area of the each pixel.

(4+4+2)

- 6A. With schematic diagram explain the Slit spectrographs.
- 6B. Briefly explain the different data reduction techniques for CCD Spectroscopy.
- 6C. Explain the computing methods to find the Signal-to-Noise ratio for CCD spectroscopy.

(4+3+3)
