**MANIPAL INSTITUTE OF TECHNOLOGY** 

## (A constituent unit of MAHE, Manipal)

MANIPAL

# SEVENTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.) END SEMESTER DEGREE EXAMINATIONS, NOVEMBER - 2019

# SUBJECT: ANALYTICAL AND OPTICAL INSTRUMENTATION [ICE 4101]

#### TIME: 3 HOURS

#### MAX. MARKS: 50

### Instructions to candidates : Answer ALL questions and missing data may be suitably assumed.

- 1A. Using neat schematic compare the working of single beam and double beam UV/Visible Spectrophotometer.
- 1B. Discuss the major causes of deviations of Beer's law.
- 1C. Compare and contrast magneto-optic effect with electro-optic effect.

(4+3+3)

- 2A. Discuss in detail about the principle, construction and applications of Attenuated Total Reflectance IR Spectroscopy. How does it differ from Fourier Transform Infrared Spectroscopy?
- 2B. With a neat schematic explain the working of On-axis Holography.
- 2C. A sample containing A and B with a mass to charge ratio 1:3 is analysed in a time of flight mass spectrometer with an accelerating voltage of 20kV and distance between the ion source and detector as 30cm. Obtain the ratio of time taken between A and B to reach the detector. What is the ratio of time if the distance is doubled to 60cm?
- (4+3+3)
  3A. What is the principle of NMR Spectroscopy? Fig.Q3A shows the NMR Spectrum of 1,4-dimethylbenzene. Interpret the signals and comment on the intensities at various peak.
- 3B. List the different components of the laser? With neat diagram explain them.
- 3C. Name the gas which is highly paramagnetic in nature and draw a schematic for its measurement.

(4+3+3)

(5+3+2)

- 4A. Derive the necessary condition for light amplification in Laser.
- 4B. Describe the working of Michelson interferometer.
- 4C. What is refractometer? Draw the figure for the same.
- 5A. What is Doppler effect? Explain the working of Laser Doppler velocimetry
- 5B. Explain how flame photometric method is used to detect the presence of sulphur dioxide.
- 5C. With the block diagram of optical fibre communication system, find loss in dB/km when an optical fibre of 400-m length has Pin =  $12 \mu$ W and Pout =  $9 \mu$ W.

(4+3+3)



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