Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS

VII SEMESTER B.TECH. (MECHATRONICS)

END SEMESTER EXAMINATIONS, December 2021

SUBJECT: INTERNETWORKING FOR INDUSTRIES [MTE 4057]

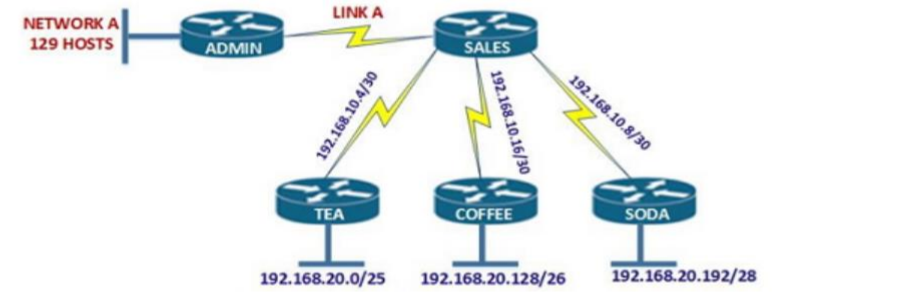
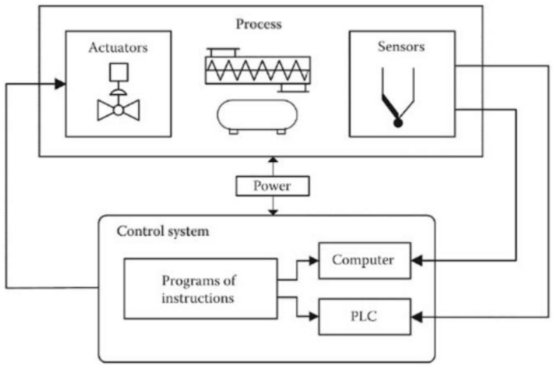
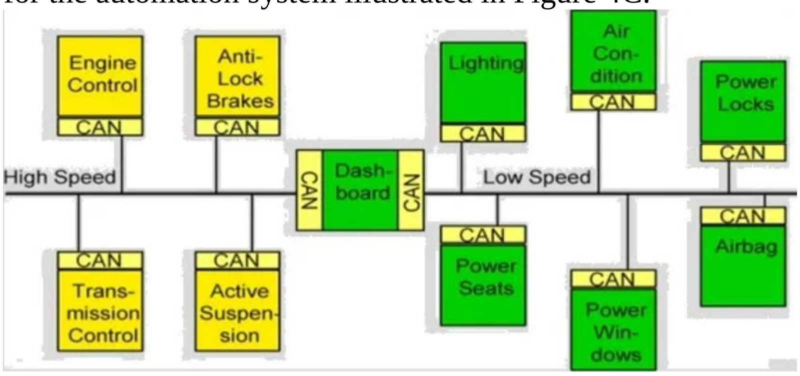
(24th December 2021)

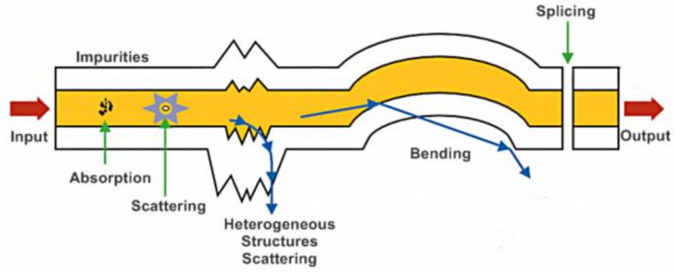
Time: 3 Hours **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.

Q. No		M	CO	PO	LO	BL
1A.	Illustrate the various avenues of communication between two systems in the physical layer of the OSI model.	**5**	**1**	**1, 2**	**1**	**3**
1B.	Develop a schematic of the various frequency bands and their usage in the EM spectrum.	**3**	**1**	**1, 2**	**1**	**3**
1C.	A pair of wires is present near an SMPS unit for powering on a communication unit. The data passing through the wires encounters EMI interference due to the power losses from the SMPS unit. As a communication engineer demonstrate how you would minimize this interference.	**2**	**1**	**1, 2, 3**	**1**	**3**
2A.	Prepare an encoding scheme by using the NRZ-L, NRZI, Bipolar AMI, Manchester and Differential Manchester coding formats to encode the message M = 01001100011.	**5**	**1**	**1, 2, 3**	**1**	**3**
2B.	Source A wishes to transmit the data 100 to Source B using the CDMA technique. Develop the algorithm to model the transmission(including encoding) and reception (including decoding) using a code of 1100.	**3**	**1**	**1, 2, 3**	**1**	**3**
2C.	A message signal $m(t) = A_m \sin(2\pi f_m t)$ is used to modulate the phase of a carrier $A_c \cos(2\pi f_c t)$ to get the modulated signal $y(t) = A_c \cos(2\pi f_c t + m(t))$. Compute the factors on which the bandwidth of the final signal depends.	**2**	**2**	**1, 2, 3**	**1, 2, 3**	**3**
3A.	Figure 3A illustrates a subnetting system.	**5**	**2**	**1, 3**	**2**	**5**

	 **Figure 3A: Subnetting system** Compute and justify your choice of the Network id, Broadcast id, First usable IP and Last usable IP address for the various subnetworks of Figure 3A.					
3B.	For a message M = 1010001101 compute the CRC frame check sequence using a pattern P = 110101. Summarize the utilization of CRC to showcase the computation of the transmitter and receiver data.	**3**	**2**	**1, 2, 3**	**2**	**3, 4**
3C.	A source of noise of 40 dB will not affect a PCM signal as much as it would affect an AM signal. Is this statement true or false? Justify your answer.	**2**	**2**	**1, 2**	**2**	**5**
4A.	Figure 4A illustrates a typical Industrial Automation system. As a Mechatronics engineer, what would be the different communication protocols of your choice for the smooth functioning of the system? Justify your choice.  **Figure 4A: Industrial Automation system**	**5**	**2**	**1, 2, 3**	**2**	**5**
4B.	Compare and contrast the major differences in the principle of operation and application of the Profibus PA and DP protocols used for Industrial Automation.	**3**	**2**	**1, 2**	**2**	**4**
4C.	Justify the need for high speed and low speed CAN communication for the automation system illustrated in Figure 4C.  **Figure 4C: CAN Communication system**	**2**	**2**	**1, 2**	**2**	**4**
5A.	Develop a commentary on the OFC losses shown in Figure 5 A.	**5**	**3**	**1,**	**1**	**3**

	 **Figure 5A: Losses in an OFC**			2		
5B.	Illustrate the functioning of a Superhetrodyne receiver used in Radio communication.	**3**	**3**	**1, 2**	**1**	**3**
5C.	The abstract of an article entitled ‘A new CubeSat design with reconfigurable multi-band radios for dynamic spectrum satellite communication networks’ authored by Ian F. Akyildiz, Josep M. Jornet, Shuai Nie and published in the Elsevier journal on Ad Hoc Networks, Volume 86, 1 April 2019, Pages 166-178, is given below. Produce a write-up on your understanding of their research findings. **ABSTRACT** *Small satellites, or CubeSats, are envisioned as a promising solution for future satellite communication networks because of their low costs and short deployment cycle. Currently, CubeSats communicate at conventionally allocated satellite communication frequencies. However, with the increase in the number of CubeSats, CubeSat-enabled communication systems, and many new use cases, new spectrum bands and a more efficient spectrum usage are needed. In this paper, a novel CubeSat design with reconfigurable multi-band radios for communication in dynamic frequencies is proposed. The multi-band radio design is realized by two complementary approaches, namely, an electronics-based and a photonics-based approach. The multi-band communication covers a wide range from radio frequencies (2–30 GHz), millimeter wave (30–300 GHz), Terahertz band (up to 10 THz), and optical frequencies (with typical bands of 850 nm/350 THz, 1300 nm/230 THz, and 1550 nm/193 THz). A thorough link budget analysis is conducted to demonstrate the potential of the proposed multi-band architecture for space information networks. Key parameters in the satellite constellation design are investigated to explore the feasibility of deployment at different altitudes in the exosphere orbit (500 km and above). A continuous global coverage is demonstrated to serve the* Internet of Space Things, *a new paradigm for next generation satellite communication networks.*	**2**	**3**	**1, 2, 3, 4**	**1, 2, 3**	**3**