Reg. No.										

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

DEPARTMENT OF MECHATRONICS

VII SEMESTER B.TECH. (MECHATRONICS)

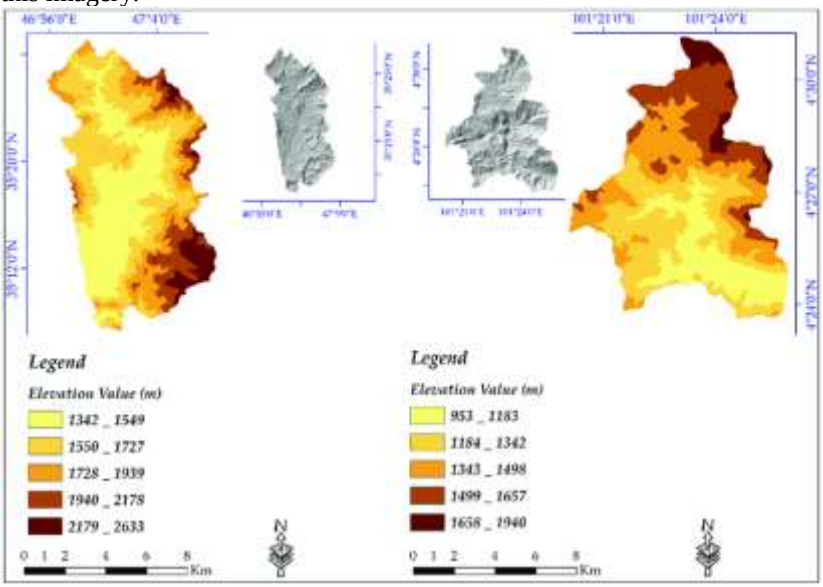
END SEMESTER EXAMINATIONS, November 2022

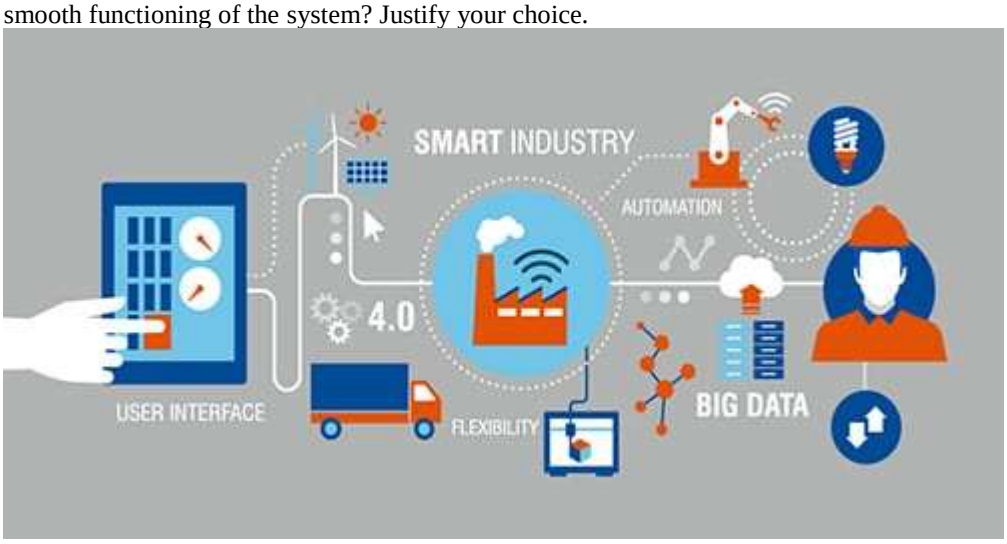
SUBJECT: INTERNETWORKING FOR INDUSTRIES [MTE 4057]

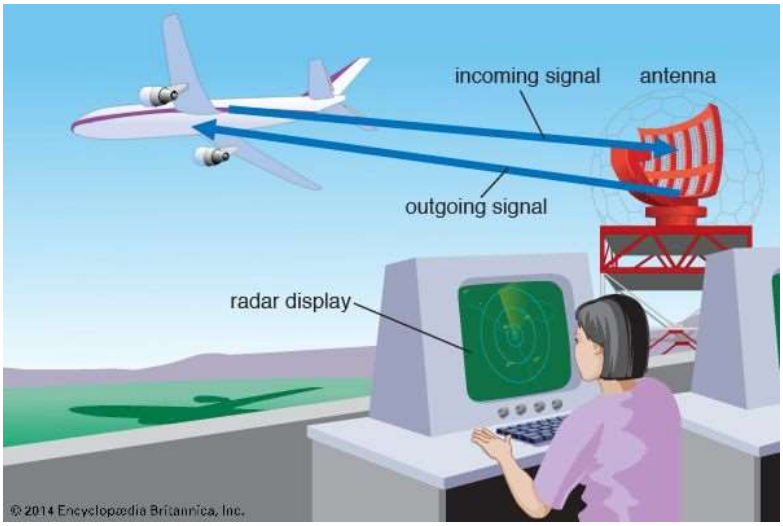
Time: 3 Hours **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.

Q. No		M	CO	PO	LO	BL
1A.	The figure below illustrates two instances of satellite elevation imagery of two patches of land as obtained by the Sentinel-1 satellite. Give your comments on the process of obtaining this imagery. 	**5**	**3**	**1, 2**	**1**	**3**
1B.	Develop a schematic of the 300 MHz to 300 GHz frequency bands and their usage in the EM spectrum.	**3**	**1**	**1, 2**	**1**	**6**
1C.	Power losses from an SMPS unit due to EMI need to be compensated for. As a communication engineer demonstrate how you would minimize this interference in a pair of twisted pair cables.	**2**	**1**	**1, 2, 3**	**1**	**3**
2A.	The figure below illustrates a signal being passed through a wireless communication channel. Noise as shown below interferes with the signal at various instances. Pictorially represent how the effect of this noise on the signal could be minimized.	**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 frequency of a carrier $A_c \cos(2\pi f_c t)$ to get a modulated signal . Compute the factors on which the bandwidth of the final signal depends.	**2**	**2**	**1, 2, 3**	**1, 2, 3**	**3**
3A.	a. You are designing a subnet mask for the 172.26.0.0 network. You want 70 subnets with up to 300 hosts on each subnet. What subnet mask should you use? b. How many subnets and hosts per subnet can you get from the network 192.168.139.0/25?	**5**	**2**	**1, 3**	**2**	**2, 5**
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.	Illustrate with the aid of a diagram, the various fields of the TCP header.	**2**	**2**	**1, 2**	**2**	**5**
4A.	The figure below 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. 	**5**	**2**	**1, 2, 3**	**2**	**5**
4B.	Compare and contrast the major differences in the principle of operation and application of the HART and Profibus protocols used for Industrial Automation.	**3**	**2**	**1, 2**	**2**	**4**
4C.	Justify the need for BACNET communication for the automation system illustrated in the figure below.	**2**	**2**	**1, 2**	**2**	**4**

						
5A.	Develop a commentary on the principle of detection demonstrated in the following figure. 	**5**	**3**	**1, 2**	**1**	**3**
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 'Novel approach of anti-resonant fiber with supporting 64 orbital angular momentum modes for optical communication' authored by Md. Mehedi Hassan et al. in the Alexandria Engineering Journal of Elsevier, Volume 62, Issue 12, December 2022, Pages 9891-9900, is given below. Produce a write-up on your understanding of their research findings. **ABSTRACT** A novel single material-based anti-resonant fiber is designed, investigated, and explored in this article with supports of up to 64 OAM modes over the 0.6 μm to 1.0 μm as operating wavelength. The other properties of the designed fiber including confinement loss (CL), OAM purity, effective refractive index differences (ERIDs), and dispersion variations provide the exceptional output. This fiber, the CL approximately varies between the 5.7031×10^{-5} dB/m to 9.2537×10^{-4} dB/m, the OAM purity is 97% to 99%, the ERIDs are higher than 10-4 for all the modes, and the least dispersion variations is −8.838 ps/km-nm for the $EH_{1,1}$ mode. All the outstanding properties of the presented fiber are calculated using the FEM and the PML within the COMSOL Multiphysics simulator. Therefore, to the ideal of our knowledge, the proposed anti-resonant fiber is mostly applicable in the high-quality long-distance fiber communications system.	**2**	**3**	**1, 2, 3, 4**	**1, 2, 3**	**3**