

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**End Semester Examination, July 2020**

**Course: Broadband Access Technology**

**Semester: VI**

**Program: B. Tech Electronics and Communication Engineering**

**Time 03 hrs.**

**Course Code: ECEG3005**

**Max. Marks: 100**

**Instructions:**

1. Attempt all the questions (Theory, Numerical, Case study etc.) on A4 size blank sheets.
2. Attempt all questions serially as per question paper.
3. The answer should be neat and clean. Draw a freehand sketch for circuits/tables/schematics wherever required.
4. Assume any data if required and indicate the same clearly.
5. Unless otherwise indicated symbols and notations have their usual meanings.
6. Scan the whole answer script and check the resolution carefully before uploading it on the blackboard. Note that answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.
7. You are expected to be honest about each attempt which you make to progress in life

**SECTION A [Case Based Study/design] 40 Marks**

S. No.		Marks	CO
Q 1	(a) What is the maximum downlink throughput of an ADSL system assuming the system uses 256 subcarriers, each with an effective bandwidth of 4 kHz, with received SNR = 12 dB, 10 dB, 8 dB, and 6 dB for 64 subcarriers each? (b) Draw ADSL modulation block diagram with neat spectrum diagram and also mention the channel numbers.	10	CO1
Q 2	The FCC assigns 6 MHz of bandwidth to each TV channel. A co-axial cable having the 0.5 inches inner diameter of shield and 0.1 inches of outer diameter of center conductor is using to transmit the TV channel. Determine the characteristic impedance and the maximum operating frequency that can supported by this cable. (Given that $\sqrt{\epsilon} = 1.15$ ).	10	CO2
Q 3	Today, millions of citizens with telephony, mobile, and broadband services. Recognizing the importance of high-speed internet to economic growth and global competitiveness, the nation's president supported an ambitious FTTH program to cover the entire country. In a city, there are 300 homes were requested for service in a	10	CO3

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hrs from the scheduled time (exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas).

No Submission will be entertained after 24 Hrs

	<p>particular area. How can you plan/ develop the network to provide the connection to everyone through FTTH program. Given that the maximum loss planned (link budget) is 21 dB, fiber loss is 0.2 dB/km. Assume that, in the given area contains 6 streets. (hint: use the power splitters)</p>		
<p>Q 4</p>	<p><b>Case study:</b> With the growth of data communications and the internet, wireless broadband became a desired alternative to fixed xDSL and cable systems. There were a number of reasons to choose wireless: some regions did not have a wired infrastructure and the cost of new roll-out was excessive. Moreover, wireless systems could provide blanket coverage much more quickly compared with the time required to build a fixed infrastructure. Accordingly in the late 1990s 2G and 3G standards moved to incorporate fast data connectivity in addition to voice services. These systems initially specified transmission rates of several hundred megabits per second, for example the first 3G release supported a 384 kbps downlink transmission link.</p> <p>At the same time several companies developed proprietary systems based on the OFDM technology. An ecosystem grew over these systems under the auspices of two IEEE standardization groups: 802.16 for wireless metropolitan area networking (MAN) and 802.20, known as Mobile Broadband Wireless Access (MBWA). In essence the two systems were targeting the same market, provision of wireless broadband connectivity using OFDM technology.</p> <p>Of the two standards, 802.16, also known as WiMAX, gained more traction. Several countries rolled out commercial systems to provide broadband access in underserved areas, including Australia, Pakistan and Russia. The first set of 802.16 standards provided a point-to-multipoint star topology architecture through fixed antennas at customer premises. The 802.16 standard did not support mobility at first, however with the growth of the mobile broadband market, the specifications evolved to support a full-fledged mobile system. It was also specified in both TDD and FDD modes to take advantage of a lower competitive barrier in the TDD market. In 2006 Sprint, a major mobile operator in the United States and Clearwire announced they had selected WiMAX to provide broadband mobile service. A number of manufacturers, including Lucent, Nokia and Samsung, developed handsets and network equipment to support the roll out of the WiMAX system.</p> <p>While WiMAX created a significant buzz in the mobile market in the mid- to late 2000s, it eventually wilted against competition from the 4G LTE standard. Several reasons have been given, including the fact that as LTE grew from the matrix of GSM/WCDMA standards, the network equipment was backwards compatible and therefore posed a lower risk/cost to incumbent operators. Further reasons include slow call set-up speed, and insufficient support at higher layers for call set-up and data packet transfer. A bigger reason perhaps was the unwillingness of major manufacturers to support multiple standards. Costs of research and development, intellectual property protection and management become too large, and a single global standard became the most efficient way forward. By 2012, the main supporters of WiMAX conceded its unviability. Two modes of LTE standards are now set to become universal technologies for provision of wireless broadband</p>	<p>10</p>	<p>CO4</p>

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hrs from the scheduled time (exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas).

No Submission will be entertained after 24 Hrs

	<b>Case Study Questions</b> <ol style="list-style-type: none"> <li>i. What were the motivations behind the development of wireless broadband systems?</li> <li>ii. What was the initial focus of 2G and 3G systems?</li> <li>iii. What are the two IEEE standards that are developed based on OFDM technology</li> <li>iv. Why was the TDD market more attractive to WiMAX?</li> <li>v. What are the costs associated with supporting two standards for operators and manufacturers?</li> <li>vi. Why was LTE successful in defeating WiMAX as a competitor, and was this inevitable?</li> </ol>		
<b>SECTION B (60 Marks)</b>			
Q 5	What is DSL technology? What are the services provided by the telephone companies using DSL? Distinguish between a DSL modem and a DSLAM	<b>4</b>	<b>CO1</b>
Q 6	Two neighbors, who live on the same street, both use ADSL service, but measurements show that one subscriber can download at approximately 1.5 Mbps and the other can download at 2.0 Mbps. Explain.	<b>3</b>	<b>CO1</b>
Q 7	Write a short note on the following modulation waveform: Carrier-less Amplitude and Phase (CAP); Discrete Multi-tone (DMT); 2B1Q	<b>8</b>	<b>CO1</b>
Q 8	Draw Data Over Cable Service Interface Specification (DOCSIS) cable network architecture. Describe the upstream and downstream data transmission of DOCSIS.	<b>5</b>	<b>CO2</b>
Q 9	Explain the DOCSIS generic MAC frame format by specifying each field in the frame.	<b>5</b>	<b>CO2</b>
Q10	Compare and contrast a traditional cable network with a hybrid fiber-coaxial network. How data transfer is achieved using CATV channels?	<b>5</b>	<b>CO2</b>
Q 11	Discuss the following multiple access techniques used in PON: Time division multiple access (TDMA), Subcarrier multiple access (SCMA), Optical code division multiple access (OCDMA), and wavelength division multiple access (WDMA).	<b>8</b>	<b>CO3</b>
Q 12	Compare FTTH, FTTN broadband access technologies	<b>2</b>	<b>CO3</b>
Q 13	A signal splitter divides a signal in half, splitting into two equal power levels. If the input to a 3-dB splitter were $-7$ dBm (in the power domain), then the output on each leg would be $-10$ dBm. Is this a true statement? What is missing here?	<b>5</b>	<b>CO3</b>
Q 14	Discuss technical features of the following wireless access systems: Free Space Optics (FSO), Direct Broadcast Satellite (DBS); IMT-2000	<b>7</b>	<b>CO4</b>
Q 15	Explain the following wireless broadband access networks: Wireless Local Loop (WLL), Local Multipoint Distribution Service (LMDS) and Multi-channel Multipoint Distribution Service (MMDS)	<b>8</b>	<b>CO4</b>

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hrs from the scheduled time (exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas).

No Submission will be entertained after 24 Hrs