

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI****B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering****NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**

(Effective from the academic year 2021 – 22)

**VII Semester**

<b>Optical &amp; Wireless Communication</b>			
Course Code	<b>21EC72</b>	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:0:1	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	2	Exam Hours	3

***Non-MCQ pattern of CIE and SEE*****Course objectives:**

This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Understand the concepts of propagation over wireless channels from a physics standpoint
- Understand the multiple access techniques used in cellular communications standards.
- Application of Communication theory both Physical and networking to understand GSM systems that handle mobile telephony.

**Teaching-Learning Process (General Instructions)**

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

**Module-1**

**Optical Fiber Structures:** Optical Fiber Modes and Configurations, Mode theory for circular waveguides, Single mode fibers, Fiber materials.

**Attenuation and Dispersion:** Attenuation, Absorption, Scattering Losses, Bending loss, Signal Dispersion: Modal delay, Group delay, Material dispersion.

[Text1 : 3.1, 3.2, 2.3[2.3.1 to 2.3.4], 2.4[2.4.1, 2.4.2],2.5, 2.7].

<b>Teaching-Learning Process</b>	Chalk and talk method, Power point presentation <b>RBT Level:</b> L1, L2, L3
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**Module-2**

**Optical Sources and detectors:** Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations, External quantum efficiency, Resonant frequencies, Photodetectors: The pin Photodetector, Avalanche Photodiodes.

<p><b>WDM Concepts:</b> Overview of WDM, Isolators and Circulators, Fiber grating filters, Dielectric thin-film filters, Diffraction Gratings.</p> <p>[Text1: 4.2 ,4.3, 6.1, 10.1, 10.3, 10.4, 10.5, 10.7]</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, Power point presentation <b>RBT Level:</b> L1, L2, L3
<b>Module-3</b>	
<p><b>Mobile Communication Engineering:</b> Wireless Network generations, Basic propagation Mechanisms, Mobile radio Channel.</p> <p><b>Principles of Cellular Communications:</b> Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Frequency Reuse Distance, Cochannel Interference and signal quality.</p> <p>[Text2: 1.4, 2.4, 2.5, 4.1 to 4.4, 4.6, 4.7]</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, Power point presentation <b>RBT Level:</b> L1, L2, L3
<b>Module-4</b>	
<p><b>Multiple Access Techniques:</b> FDMA, TDMA, CDMA, SDMA, Hybrid Multiple Access Techniques, Multicarrier Multiple Access Schemes.</p> <p><b>A Basic Cellular System:</b> A basic cellular system connected to PSTN, Parts of basic cellular system, Operation of a cellular system.</p> <p>[Text2: 8.2, 8.3, 8.4.5, 8.5, 8.6, 8.10, 9.2.2, 9.2.3, 9.3]</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, Power point presentation <b>RBT Level:</b> L1, L2, L3
<b>Module-5</b>	
<p><b>Global System for Mobile (GSM):</b> GSM Network Architecture, GSM signalling protocol architecture, Identifiers used in GSM system, GSM Channels, Frame structure for GSM, GSM Call procedures, GSM hand-off Procedures, GSM Services and features.</p> <p>[Text2: 11.1, 11.2, 11.3, 11.4, 11.5, 11.8, 11.9, 11.10]</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, Power point presentation <b>RBT Level:</b> L1, L2, L3
<p><b>Course outcomes (Course Skill Set)</b></p> <p>At the end of the course the student will be able to:</p> <ol style="list-style-type: none"> <li>Classification and characterization of optical fibers with different modes of signal propagation.</li> <li>Describe the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and reception.</li> <li>Understand the essential concepts and principles of mobile radio channel and cellular communication.</li> <li>Describe various multiple access techniques used in wireless communication systems.</li> <li>Describe the GSM architecture and procedures to establish call set up, call progress handling and call tear down in a GSM cellular network.</li> </ol>	
<p><b>Assessment Details (both CIE and SEE)</b></p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together</p> <p><b>Continuous Internal Evaluation (CIE):</b></p> <p>CIE will be the same as other core theory courses.</p>	

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination (SEE):**

***For non-MCQ pattern of CIE and SEE***

**Continuous Internal Evaluation (CIE):**

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of CIE for the course.

**Three Unit Tests each of 20 Marks (duration 01 hour)**

1. First test at the end of 5<sup>th</sup> week of the semester
2. Second test at the end of the 10<sup>th</sup> week of the semester
3. Third test at the end of the 15<sup>th</sup> week of the semester

**Two assignments each of 10 Marks**

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

**Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)**

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:**

**Text Books**

1. Gerd Keiser, Optical Fiber Communication, 5<sup>th</sup> Edition, McGraw Hill Education (India) Private Limited, 2016. ISBN:1-25-900687-5.
2. T L Singal, Wireless Communications, McGraw Hill Education (India) Private Limited, 2016, ISBN:0-07-068178-3.

**Reference Books**

1. John M Senior, Optical Fiber Communications, Principles and Practice, 3<sup>rd</sup> Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3
2. Theodore Rappaport, Wireless Communications: Principles and Practice, 2<sup>nd</sup> Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.
3. Gary Mullet, Introduction to Wireless Telecommunications Systems and Networks, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN - 13: 978-81-315-0559-5.