**Curriculum Plan (EVEN SEM 2024): B. Sc. (H) Mathematics III Year (Semester VI)**

**Paper: Introduction to Information Theory and Coding Theory**

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| **Dr. Tajender Kumar**  Assistant Professor  Department of Mathematics  Kalindi College (University of Delhi)  Delhi- 110008  Mobile: +91 7417837644  **E- mail**: [tajenderkumar@kalindi.du.ac.in](mailto:tajenderkumar@kalindi.du.ac.in) | |  | **Marks Distribution** | **Theory** | 75 Marks | |
| **Internal Assessment** | Assignments 10 Marks | |
| Home Exams/ 10 Marks  Class Test | |
| Attendance 5 Marks | |
| **Classes Assigned** | **Lectures** | 5 per week (**Theory**) | |
| **Tutorial** | 1 per week | |
| **References** |  | 1. Cover, Thomas M., & Thomas, Joy A. (2006). Elements of Information Theory (2nd ed.). Wiley India. Indian Reprint 2014. 2. Gallian, Joseph. A. (2013). Contemporary Abstract Algebra (8th ed.). Cengage Learning India Private Limited. Delhi. Fourth impression, 2015. 3. Reza, Fazlollah M. (1961). An Introduction to Information Theory. Dover Publications Inc, New York. Reprint 1994. 4. Roth, Ron M. (2007). Introduction to Coding Theory. Cambridge University Press. | | | | |
|  | **Beginning/1st week with 3 days**  18th Jan. - 27th Jan. | **Topics**  Communication processes, A model of communication system, A quantitative measure of information, Binary unit of information.  [3] Chapter 1 (Sections 1.1 to 1.7). | | | |  |
|  | **2nd week**  29th Jan. – 03rd Feb | Communication processes, A model of communication system, A quantitative measure of information, Binary unit of information.  [3] Chapter 1 (Sections 1.1 to 1.7). | | | |  |
|  | **3rd week**  05th Feb. – 10th Feb. | A measure of uncertainty, H function as a measure of uncertainty, Sources and  binary sources, Measure of information for two-dimensional discrete finite probability schemes. [3] Chapter 3 (Sections 3.1 to 3.7). | | | |  |
|  | **4th week**  12th Feb. - 17th Feb. | A measure of uncertainty, H function as a measure of uncertainty, Sources and binary sources, Measure of information for two-dimensional discrete finite probability schemes. [3] Chapter 3 (Sections 3.1 to 3.7). | | | |  |
|  | **5th week**  19th Feb.- 24th Feb. | A sketch of communication network, Entropy, Basic relationship among different entropies, A measure of mutual information, Interpretation of Shannon’s fundamental inequalities; redundancy, efficiency and channel capacity, Binary symmetric channel, Binary erasure channel, Uniqueness of the entropy function. [3] Chapter 3 (Sections 3.9, 3.11 to 3.16 and 3.19) [1] Chapter 2 (Section 2.1). | | | |  |
|  | **6th week**  26th Feb. – 02nd Mar. | A sketch of communication network, Entropy, Basic relationship among different entropies, A measure of mutual information, Interpretation of Shannon’s fundamental inequalities; redundancy, efficiency and channel capacity, Binary symmetric channel, Binary erasure channel, Uniqueness of the entropy function. [3] Chapter 3 (Sections 3.9, 3.11 to 3.16 and 3.19) [1] Chapter 2 (Section 2.1). | | | |  |
|  | **7th week**  04thMar. **–** 09th Mar. | Joint entropy and conditional entropy, Relative entropy and mutual information, Chain rules for entropy, Conditional relative entropy and conditional mutual information, Jensen’s inequality and its characterizations, The log sum inequality and its applications. [1] Chapter 2 (Sections 2.2 to 2.7). | | | |  |
|  | **8th week**  11th Mar. – 16th Mar. | Joint entropy and conditional entropy, Relative entropy and mutual information, Chain rules for entropy, Conditional relative entropy and conditional mutual information, Jensen’s inequality and its characterizations, The log sum inequality and its applications. [1] Chapter 2 (Sections 2.2 to 2.7). | | | |  |
|  | **9th week**  18th Mar.– 23rd Mar. | Block codes, Hamming distance, Maximum likelihood decoding, Levels of error handling, Error correction, Error detection, Erasure correction, Construction of finite fields. [4] Chapter 1 (Sections 1.2 to 1.5, excluding 1.5.3), and Chapter 3 (Sections 3.1 to 3.4). | | | |  |
|  | **10th week**  01st Apr. – 06th Apr. | Block codes, Hamming distance, Maximum likelihood decoding, Levels of error handling, Error correction, Error detection, Erasure correction, Construction of finite fields. [4] Chapter 1 (Sections 1.2 to 1.5, excluding 1.5.3), and Chapter 3 (Sections 3.1 to 3.4). | | | |  |
|  | **11th week**  08th Apr. – 13th Apr. | Linear codes, Matrix representation of linear codes, Orthogonality relation, Encoding of linear codes, Decoding of linear codes. [4] Chapter 2 (Sections 2.1 to 2.4). [2] Chapter 31 (Lemma and Theorem 31.3 on Page 538). | | | |  |
|  | **12th week**  15th Apr. – 20th Apr. | Linear codes, Matrix representation of linear codes, Orthogonality relation, Encoding of linear codes, Decoding of linear codes. [4] Chapter 2 (Sections 2.1 to 2.4). [2] Chapter 31 (Lemma and Theorem 31.3 on Page 538). | | | |  |
|  | **13th week**  22nd Apr. – 27th Apr. | Singleton bound and maximum distance separable codes, Sphere-packing bound and perfect codes, Gilbert−Varshamov bound, MacWilliams’ identities. [4] Chapter 4 (Sections 4.1 to 4.4) and Chapter 11 (Section 11.1). | | | |  |
|  | **14th week**  29th Apr. – 04th May. | Singleton bound and maximum distance separable codes, Sphere-packing bound and perfect codes, Gilbert−Varshamov bound, MacWilliams’ identities. [4] Chapter 4 (Sections 4.1 to 4.4) and Chapter 11 (Section 11.1). | | | |  |
|  | **15th week**  06th May. – 11th May. | Revision | | | |  |
| Dispersal of classes, preparation leave and practical examination begin- 12 May, 2024. | | | | | | |