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|  | **BS(IT) Session 2019-23 Sem-2****(List of Courses to be Offered)** |  |
| **Sr. No** | **C.Code** | **Course Title** | **Cr. Hr** |
| 1 | CSI-302 | Object Oriented Programming | 4(3-1) |
| 2 | ENG-421 | Communication Skills | 3(3-0) |
| 3 | CSI-405 | Discrete Structures | 3(3-0) |
| 4 | PST-321 | Pakistan Studies | 2(2-0) |
| 5 | CIT-332 | Operations Research | 3(3-0) |
| 6 | MTH-424 | Linear Algebra | 3(3-0) |
| **Total** | **18** |

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| **Object Oriented Programming** |
| **Course Contents:** |
| Introduction to object oriented design, history and advantages of object oriented design, introduction to object oriented programming concepts, classes, objects, data encapsulation, constructors, destructors, access modifiers, const vs non-const functions, static data members & functions, function overloading, operator overloading, identification of classes and their relationships, composition, aggregation, inheritance, multiple inheritance, polymorphism, abstract classes and interfaces, generic programming concepts, function & class templates, standard template library, object streams, data and object serialization using object streams, exception handling.  |
| **Reference Material:** |
| 1. Starting Out with C++ from Control Structures to Objects, 9th Edition, Tony Gaddis 2. C++ How to Program, 10th Edition, Deitel & Deitel. 3. Object Oriented Programming in C++, 3rd Edition by Robert Lafore 4. Java: How to Program, 9th Edition by Paul Deitel 5. Beginning Java 2, 7th Edition by Ivor Horton 6. An Introduction to Object Oriented Programming with Java, 5th Edition by C. Thomas Wu  |

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| **Communication Skills** |
| **Course Contents:** |
| Principles of writing good English, understanding the composition process: writing clearly; words, sentence and paragraphs; Comprehension and expression; Use of grammar and punctuation. Process of writing, observing, audience collecting, composing, drafting and revising, persuasive writing, reading skills, listening skills and comprehension, skills for taking notes in class, skills for exams; Business communications; planning messages, writing concise but with impact. Letter formats, mechanics of business, letter writing, letters, memo and applications, summaries, proposals, writing resumes, styles and formats, oral communications, verbal and non-verbal communication, conducting meetings, small group communication, taking minutes. Presentation skills; presentation strategies, defining the objective, scope and audience of the presentation, material gathering material organization strategies, time management, opening and concluding, use of audio-visual aids, delivery and presentation.  |
| **Reference Material:** |
| 1. Practical Business English, Collen Vawdrey, 1993, ISBN = 0256192740 2. Effective Communication Skills: The Foundations for Change, John Nielsen, 2008, ISBN = 1453506748  |

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| **Discrete Structures** |
| **Course Contents:** |
| Mathematical reasoning, propositional and predicate logic, rules of inference, proof by induction, proof by contraposition, proof by contradiction, proof by implication, set theory, relations, equivalence relations and partitions, partial orderings, recurrence relations, functions, mappings, function composition, inverse functions, recursive functions, Number Theory, sequences, series, counting, inclusion and exclusion principle, pigeonhole principle, permutations and combinations, elements of graph theory, planar graphs, graph coloring, euler graph, Hamiltonian path, rooted trees, traversals.  |
| **Reference Material:** |
| 1. Discrete Mathematics and Its Applications, 7th edition by Kenneth H. Rosen 2. Discrete Mathematics with Applications, 4th Edition by Susanna S. Epp 3. Discrete Mathematics, 7th edition by Richard Johnson Baugh 4. Discrete Mathematical Structures, 4th edition by Kolman, Busby & Ross 5. Discrete and Combinatorial Mathematics: An Applied Introduction by Ralph P. Grimaldi 6. Logic and Discrete Mathematics: A Computer Science Perspective by Winifred Grassman  |

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| **Pakistan Studies** |
| **Course Contents:** |
| Historical background of Pakistan: Muslim society in Indo-Pakistan, the movement led by the societies, the downfall of Islamic society, the establishment of British Raj- Causes and consequences. Political evolution of Muslims in the twentieth century: Sir Syed Ahmed Khan; Muslim League; Nehru; Allama Iqbal: Independence Movement; Lahore Resolution; Pakistan culture and society, Constitutional and Administrative issues, Pakistan and its geo-political dimension, Pakistan and International Affairs, Pakistan and the challenges ahead.  |
| **Reference Material:** |
| 1. The Emergence of Pakistan, Chaudary M., 1967 2. The making of Pakistan, Aziz. 1976 3. A Short History of Pakistan, I. H. Qureshi, ed., Karachi, 1988  |

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| **Operations Research** |
| **Course Contents:** |
| Introduction to operations research, History of operations research, Applications, Modeling the linear programming, Linear programming, Geometry, Solving the linear programming, the Simplex method, Shadow price, Theory of the simplex method, Duality, Dual theory, Sensitivity analysis, Other algorithms for linear programming, The dual simple method, Big – M method, The tow phase method, The transportation and assignment problems, The transportation problem, A streamlined simplex method for transportation problem, The assignment problem, A special algorithm for the assignment problem, Dynamic programming, Characteristic of dynamic programming, Deterministic dynamic programming, Integer programming, Prototype examples, BIP applications and formulation examples, Some perspectives on solving integer programming problems, The branch-and-cut approach to solve BIP problems, The incorporation of constraint programming.  |
| **Reference Material:** |
| 1. Frederick S. Hiller, Gerald J. Lieberman, Introduction to Operations Research, 9th Edition, English, McGraw-Hill, 2010. 2. W. Winston, Operations Research, Duxbury Press. 3. Operations Research: Applications and Algorithms, Wayne L Winston, Indian University, 4th edition, 2004  |

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| **Linear Algebra** |
| **Course Contents:** |
| Algebra of linear transformations and matrices. determinants, rank, systems of equations, vector spaces, orthogonal transformations, linear dependence, linear Independence and bases, eigenvalues and eigen vectors, characteristic equations, Inner product space and quadratic forms  |
| **Reference Material:** |
| 1. Elementary Linear Algebra by Howard Anton 2. Linear Algebra and its Applications by Gibert Strang  |