

CONTENTS

Preface	vii
1. Computers	1 – 12
1. Brief description about a computer	1
2. Operating system	2
3. Coding system	3
4. Translators	3
5. Algorithm	5
6. Flowchart	8
7. Review Questions	9
8. Multiple Choice Questions	11
2. Language C	13 – 55
1. Introduction	13
2. Arithmetic operators	17
3. Assignment operators	18
4. Library functions	18
5. Input and output	19
6. Relational operators	24
7. Logical operators	24
8. Control statements	25
9. Looping	33
10. Arrays	44
11. Functions	47
12. Review Questions	49
13. Multiple Choice Questions	52
3. C++ Language	56 – 66
1. Introduction	56
2. Input and output	57
3. Review Questions	60
4. Multiple Choice Questions	63
4. Error Analysis	67 – 82
1. Random and systematic errors	67
2. Significant figures	68
3. Approximate numbers	69
4. Rounding off of numbers	69

5. Presentation of errors	72
6. Index of accuracy	73
7. Error formulas	74
8. Convergence	80
9. Review Questions	80
10. Multiple Choice Questions	81

5. Interpolation 83 – 119

1. Linear least square fitting	83
2. Non-linear fit	87
3. Lagrange's interpolation	92
4. Hermite's interpolation	97
5. Divided differences	98
6. Newton's interpolation with divided differences	98
7. Difference schemes	100
8. Newton interpolation	104
9. Gauss interpolation	109
10. Stirling's interpolation	113
11. Bessel interpolation	114
12. Laplace-Everett interpolation	115
13. Review Questions	117
14. Multiple Choice Questions	119

6. Differentiation 120 – 138

1. Differentiation using Newton's divided difference interpolation	120
2. Differentiation using Newton's forward interpolation	122
3. Differentiation using Newton's backward interpolation	124
4. Differentiation using Gauss forward interpolation	127
5. Differentiation using Gauss backward interpolation	129
6. Differentiation using Stirling's interpolation	131
7. Differentiation using Bessel interpolation	133
8. Differentiation using Laplace-Everett interpolation	135
9. Review Questions	137

7. Integration 139 – 171

1. Newton-Cotes expression	139
2. Trapezoidal rule	141
3. Simpson rule	144
4. Newton's three-eight rule	148
5. Boole's rule	152

6. Gauss quadrature method	155
7. Monte Carlo method	164
8. Numerical double integration	166
9. Review Questions	169
10. Multiple Choice Questions	170
8. Roots of Equation	172 – 206
1. Roots of a quadratic equation	173
2. Limits for real roots of a polynomial equation	175
3. Bisectional method	181
4. False position method	187
5. Newton-Raphson method	194
6. Secant method	202
7. Review Questions	204
8. Multiple Choice Questions	205
9. Simultaneous Linear Equations	207 – 244
1. Basic operations	208
2. Gauss elimination method	209
3. Pivotal condensation method	215
4. Gauss-Jordan method	221
5. Matrix inversion method	227
6. Gauss-Jacobi method (Iterative method)	234
7. Gauss-Seidel method	239
8. When the number of linear equations is larger than that of unknowns	241
9. Review Questions	242
10. Multiple Choice Questions	244
10. Eigenvalues and Eigenvectors	245 – 290
1. Eigenvalues and eigenvectors of a real symmetric matrix of order 2×2	246
2. Eigenvalues and eigenvectors of a real asymmetric matrix of order 2×2	250
3. Eigenvalues and eigenvectors of a real matrix whose elements can be written in the form of square matrices along the diagonal and the rest elements are zero	254
4. Determinant of a matrix	259
5. Characteristic equation	266
6. Power method	272

7. Inverse power method	277
8. Jacobi method	283
9. Review Questions	287
10. Multiple Choice Questions	290
11. Differential Equations	291 – 328
1. Picard method	292
2. Taylor method	294
3. Euler method	298
4. Henn method	302
5. Runge-Kutta method	306
6. Predictor-corrector method	311
7. Predictor-corrector methods with difference schemes	318
8. Review Questions	325
9. Multiple Choice Questions	328
12. Partial Differential Equations	329 – 355
1. Elliptic partial differential equations	329
2. Parabolic partial differential equations	345
3. Hyperbolic partial differential equations	350
4. Review Questions	354
5. Multiple Choice Questions	355
13. Random Numbers	356 – 369
1. Random numbers	356
2. Monte Carlo method	363
3. Simulation	364
4. Review Questions	368
5. Multiple Choice Questions	369
14. Statistical Parameters	370 – 399
1. Arithmetic mean	370
2. Median	375
3. Mode	383
4. Mean deviation	387
5. Standard deviation	390
6. Correlation	393
7. Review Questions	396
8. Multiple Choice Questions	399
Bibliography	401
Index	403 – 404