Syllabus
M.Sc. IV SEM
2019-20
Govt. (Autonomous) Holkar Science College, Indore (M.P.)
(Syllabus)
(Approved by Board of Studies of College)
(2019-20)

Class: M.Sc. IV Sem.
Subject: Mathematics
Paper: I (Compulsory)
Title: Functional Analysis- II
Max Marks: (Theory + CCE) 75+25 =100

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIT-I</td>
<td>Uniform boundedness theorem and some of its consequences Weak and strong convergence, Open mapping theorem, Closed graph theorem. [TB-1: Art. 4.7, 4.8, 4.12, 4.13 &amp; TB-2 Chapter VIII &amp; X]</td>
</tr>
<tr>
<td>UNIT-II</td>
<td>Hahn-Banach theorem for real linear space, Hahn-Banach theorem for complex linear space and Normed linear space. [TB-1: Arts. 4.2, 4.3 &amp; TB-2: Chapter VIII]</td>
</tr>
<tr>
<td>UNIT-III</td>
<td>Reflexive Space, Inner product space and Hilbert space and their properties, Orthonormal sets, Bessel’s Inequality, Orthonormal sets and Parsevals’s Identity. [TB-1 Art. 3.3, 3.4, 3.5-2, 3.5-3, 3.6 &amp; TB-2: Chapter IX &amp; Chapter XVII Art. 3]</td>
</tr>
<tr>
<td>UNIT-IV</td>
<td>Projection Mapping, Projection theorem, Riesz representation Theorem. [TB-1: Art. 3.3-3 to 3.3-7, 3.8 &amp; TB-2: Chapter IX]</td>
</tr>
<tr>
<td>UNIT-V</td>
<td>Adjoint of an operator on Hilbert Space, Reflexivity of Hilbert spaces, Self-adjoint operators, Positive operators Projection Normal and Unitary operators. [TB-1: Art. 3.9, 3.10, 4.6-6 &amp; TB-2: Chapter X]</td>
</tr>
</tbody>
</table>

TB = Text Book

Text Books:


Reference Books:

1. B. Choudhary and Sudarshan Nanda. Functional Analysis with applications, Wiley Eastern Ltd

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(Syllabus)

Class: M.Sc. Sem. IV
Subject: Mathematics
Paper: II (Compulsory)
Title: Advanced Special Functions
Max Marks: (Theory + CCE) 75+25 =100

<table>
<thead>
<tr>
<th>UNIT-I</th>
<th>Generating Functions: The generating function concept. Generating functions of the form ( G(2xt^t) ) Sets generated by ( e^{yt}). The generating functions ( A(t)exp[-xt/(1-t)] ). Another Class of generating functions. Art 71 – 75.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIT-III</td>
<td>Hermite polynomials: Definition of Hermite polynomials ( H_n(x) ), recurrence relation, Hermite differential equation, Rodrigues formula, orthogonality, Expansion of polynomials, more generating functions. Art 103 – 111.</td>
</tr>
<tr>
<td>UNIT-IV</td>
<td>Laguerre Polynomials: The Laguerre polynomials ( L_n(x) ), Generating Functions, pure recurrence relations, Differential recurrence relation, Rodrigues formula, orthogonality, Expansion of polynomials, special properties. Art 112 – 119, 121.</td>
</tr>
<tr>
<td>UNIT-V</td>
<td>Jacobi Polynomial: Jacobi Polynomial, other forms of Jacobi Polynomial, Bateman’s generating function, Rodrigues formula, Orthogonality. Art 132 – 135.</td>
</tr>
</tbody>
</table>

**Books Recommended**


**Reference Books**

2. Shrivastav, H. M. Gupta, K.C. and Goyal, S.P. the \( H \)-functions of one and two variables with application South asian publication, New Delhi.
Govt. (Autonomous) Holkar Science College, Indore (M.P.)
(Syllabus)
(Approved by Board of Studies of College)
(2019-20)

Class: M.Sc. IV Sem.
Subject: Mathematics
Paper: III (Optional)
Title: Advanced Fuzzy Mathematics
Max Marks: (Theory + CCE) 75+25 =100

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Topic</th>
</tr>
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<tbody>
<tr>
<td>UNIT-II</td>
<td>Possibility Theory – Fuzzy Measures, Evidence Theory, Necessity measure, Possibility measure, possibility distributions Possibility theory and Fuzzy sets possibility theory versus probability theory.</td>
</tr>
</tbody>
</table>

Text Book:

Book Recommended:
Fuzzy Sets and uncertainty and Information by G.J. Kalia tina A. Foljer- Prentice- Hall of India.
Govt. (Model, Autonomous) Holkar Science, College Indore (M.P.)
(Department of Higher Education, Govt. of M.P.)
CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus
(Session 2019-20)

Class: M.Sc. (Mathematics) Title: Theory of Linear Operators – II

Semester – IV Paper IV
Max Marks: 100 (Theory + CCE = 75 + 25)

UNIT – I
Bounded self-adjoint linear operators and their spectral properties. Positive operators and their square roots. (Art. No. 9.1 – 9.4 from 1)

UNIT – II
Projection operators and their properties. Spectral family. Bounded self-adjoint operators and their spectral family. (Art. No. 9.5 – 9.8 from 1)

UNIT – III

UNIT – IV
Unbounded linear operators and their Hilbert adjoint operators. Hilbert adjoint operators, symmetric and self-adjoint linear operators. Closed linear operators and closures. (Art. No. 10.1 – 10.3 from 1)

UNIT – V

Text Book:

Reference Books:
3. B. Choudhary and S. Nanda: Functional analysis with applications, Wiley Eastern, Ltd.,
### Govt. (Autonomous) Holkar Science College, Indore (M.P.)
#### (Syllabus)

Semesterwise syllabus (CBCS) for M.Sc. Approved by Board of Studies of College for session 2019 – 20

<table>
<thead>
<tr>
<th>Class</th>
<th>M.Sc. IV Sem.</th>
</tr>
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<tbody>
<tr>
<td>Subject</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Paper</td>
<td>V(Optional)</td>
</tr>
<tr>
<td>Title</td>
<td>Analytic Number Theory-II</td>
</tr>
<tr>
<td>Max Marks</td>
<td>(Theory + CCE) 75+25 =100</td>
</tr>
</tbody>
</table>

### UNIT-I

Chap 11 – art 11.6, 11.7, 11.9.

### UNIT-II

Art- 11.10 – 11.12.

### UNIT-III

Chap 12 – art 12.1 – 12.4

### UNIT-IV
The analytic continuation of Hurwitz zeta function. The analytic continuation of Riemann zeta function and Dirichlet L-functions. The Hurwitz’s formula. The functional equation for the Riemann zeta function and Hurwitz zeta function.

Art 12.5 – 12.9.

### UNIT-V
Evaluation of $\xi(-n,a)$. Bernoulli numbers and Bernoulli polynomials. Properties. Formula for $L(0,\chi)$. Differential equation satisfied By Bernoulli polynomials. Recursion formula for computing Bernoulli numbers. Formula for $L(0, \chi)$.

Art 12.11 – 12.13

### Book Recommended:
# Operations Research-II

<table>
<thead>
<tr>
<th>Unit</th>
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</tr>
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<tbody>
<tr>
<td><strong>Unit-1</strong></td>
<td>Transportation problems: North-West Corner Method, Least-Cost Method, Vogel's Approximation Method, MODI Method.</td>
</tr>
<tr>
<td><strong>Unit-2</strong></td>
<td>Exceptional cases and problems of degeneracy, Assignment problems.</td>
</tr>
<tr>
<td><strong>Unit-3</strong></td>
<td>Network analysis, constraints in Network, Construction of network, Critical Path Method (CPM), PERT, PERT Calculation, Resource Leveling by Network Techniques and advances of network (PERT/CPM) Simulation: Monte-Carlo Simulation.</td>
</tr>
<tr>
<td><strong>Unit-4</strong></td>
<td>Simulation of Networks, Advantage and Limitation of Simulation.</td>
</tr>
</tbody>
</table>
| **Unit-5** | Game theory - Two persons, Zero-Sum Games, Maximix - Minimax principle, games without saddle points - Mixed strategies, Graphical solution of 2xm and mx2 games, Solution by Linear Programming, Non-
Recommended Books :-

Reference Books:-
1- S.D, Sharma, Operation Research,
4- G. Hadley, Linear and Dynamic programming, Addison - Wesley Reading Mass.
6- Prem Kumar Gupta and D.S. Hira, Operation Research, an Introduction, S. Chand & Company Ltd. New Delhi.