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

Class: M.Sc. III Sem.
Subject: Mathematics
Paper: I (Compulsory)
Title: Functional Analysis
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>Normed linear spaces, Properties of Normed linear spaces, Branch Space &amp; Example, Convex Sets in Normed linear spaces. [TB-1: Art.3.1,3.2,2.2,2.3 &amp; TB-2: Chapter VI]</td>
</tr>
<tr>
<td>UNIT-II</td>
<td>Finite Dimensional Normed linear spaces &amp; Subspaces. Basic Properties of Finite Dimensional Normed linear spaces. Equivalent norms, Riesz lemma and compactness. [TB-1: Art. 2.4, 2.5 &amp; TB-2 Chapter VI]</td>
</tr>
<tr>
<td>UNIT-III</td>
<td>Quotient Space of Normed linear spaces and its completeness, Liner operators and their elementary properties. [TB-1: Art. 2.6 &amp; TB-2 Chapter VI]</td>
</tr>
<tr>
<td>UNIT-IV</td>
<td>Normed linear spaces operators, Bounded Linear operators &amp; continuous operators, [TB-1: Art. 2.7, 2.10-1, 2.10-2 &amp; TB-2: Chapter VII]</td>
</tr>
<tr>
<td>UNIT-V</td>
<td>Linear functional, bounded Linear functional, Dual spaces with examples. [TB-1: Art. 2.8, 2.10-3 to 2.10-7 &amp; TB-2 Chapter VIII up to Art.3]</td>
</tr>
</tbody>
</table>

TB = Text Book

Text Books:

Reference Books:
1. B. Choudhary and Sudarshan 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 ]

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

| UNIT-I | The Gamma & Beta Functions: The Euler or Mascheroni Constant $\gamma$, The Gamma function, A Series for $\Gamma(z)/\Gamma(z)$ The Euler Product For $\Gamma(z)$ The difference equation Euler Integral for $\Gamma(z)$ Beta function The value of $\Gamma(z)\Gamma(1-z)$, Factorial Function, Legendre’s duplication formula, Gauss multiplication theorem. Art 7 - 12, Art 15 - 20. |
| UNIT-IV | Bessel functions: Definition of $J_n(z)$ Bessel’s differential equation, Differential recurrence relations. A pure recurrence relation. A generating function. Bessel’s integral Index half an odd integer. Art 57 - 64. |

Books Recommended


Reference Books


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

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

<table>
<thead>
<tr>
<th>UNIT-I</th>
<th>Fuzzy Versus Crisp Number System, Interval Sets, Representation of A Set Type of Sets, Subsets, Universal Set. Operations On Sets, Some important Results on Venn Diagrams Fuzzy Sets Fuzzy Set Definition Different types of Fuzzy Sets General Definitions and Properties of Fuzzy Sets.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIT-III</td>
<td>t-norms and t-conorms Definition Of Intersection and Union by Hamacher Yager's Union and Intersection of Two Fuzzy Sets as Defined by Defined by Dubois and Prade Aggregation Operations Extension Principle For Fuzzy Sets Summary.</td>
</tr>
<tr>
<td>UNIT-IV</td>
<td>Extension principal for fuzzy sets – The zadeh’s extension principle.</td>
</tr>
</tbody>
</table>

Text Book:
2. Fuzzy Sets and Fuzzy Logic by G. J. Klor and B. Yuan Prentice- Hall of India, New Delhi, 1995

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 – I

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

UNIT – I
Spectral theory in finite dimensional normed space. Basic concept: Resolvent set and Spectrum.
Spectral properties of bounded linear operators. Properties of resolvent and spectrum.
( Art. No. 7.1 – 7.4 from 1)

UNIT – II
( Art. No. 7.5 – 7.7 from 1)

UNIT – III
Compact linear operators on normed linear spaces and their properties.
( Art. No. 8.1 – 8.2 from 1)

UNIT – IV
( Art. No. 8.3 – 8.5 from 1)

UNIT – V
Theorems of Fredholm’s type. Fredholm alternative and fredholm alternative theorem.
( Art. No. 8.6 – 8.7 from 1)

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

Class: M.Sc. III Sem.
Subject: Mathematics
Paper: V (Optional)
Title: Analytic Number Theory
Max Marks: (Theory + CCE) 75+25 =100

Chap 2- art 2.1-2.10, Chap art 3.2, 3.3, 3.4 |
| UNIT-II | Abel's identity for arithmetical functions. Finite abelian groups & their characters; Construction of subgroups, The character group, The orthogonality relations for characters. 
Theorem 4.2, chap 6-6.4 – 6.7 |
| UNIT-III | Dirichlet characters. Sums involving Dirichlet characters, The non-vanishing of \( L(1, \chi) \) for real non-principal \( \chi \). Dirichlet theorem on primes, primes of form 4n-1 and 4n+1. 
Art 6.8 – 6.10, chap 7- art 7.1, 7.2. |
| UNIT-IV | The plan of the proof of Dirichlet theorem on primes. Distribution of primes in arithmetic progression. 
Art – 7.3 – 7.9. |
| UNIT-V | Dirichlet Series and Euler Products: Definition and different types of Dirichlet series. The half-plane of absolute convergence of a Dirichlet series. The function defined by a Dirichlet series, Uniqueness theorem, multiplication of Dirichlet series, Euler products. 
Chap 11 – art 11.1 – 11.5. |

Book Recommended:

Govt. (Model, Autonomous) Holkar Science, College Indore (M.P.)
(Department of Higher Education, Govt. of M.P.)
Semester wise Syllabus for post graduates
CHOICE BASED CREDIT SYSTEM (CBCS)
(With effect from the Academic year 2019-20)

Syllabus

Class – M.Sc./MA (Semester-III)
Mathematics Modeling

Subject: Mathematics
Paper- Interdisciplinary Theory Paper

Max Marks: 100 (Theory + CCE = 75+25)

Syllabus

UNIT I:
Simple situation requiring mathematical modelling. Techniques, classification and characteristics of mathematical models. Limitations of mathematics modelling.

UNIT II:
Setting up first order differential equations, qualitative solution, stability of solutions, growth and decay population models, exponential and logistic population models.

UNIT III:
Compartment models through system of ODE. Mathematics models in medicine, arms race, battles and international trade in terms of system of ODE.

UNIT IV:
Non-linear difference equations models for population growth probability generating function, fourth method of obtaining partial differential equation models. PDE model for a stochastic epidemic process with no removal. Model for traffic on a highway.

UNIT V:
General Communication networks, general weighted digraphs, map-colouring problems.

Reference Books:
2. Martin Brann C.S Coleman, DA Drew (Eds) differential equation models.
3. C.L.Liu, Elements of discrete mathematics.
**Department of Higher Education, Govt. of M.P.**
**M.Sc./M.A (Post Graduates) Semester wise Syllabus**
**As recommended by Central Board of Studies and approved by the Governor of M.P.**

<table>
<thead>
<tr>
<th>कक्षा Class</th>
<th>M.Sc./M.A (Mathematics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>सेमेस्टर Semester</td>
<td>II</td>
</tr>
<tr>
<td>विषय समूह का सीमित Title of Subject/ Group</td>
<td>Operations Research-I</td>
</tr>
<tr>
<td>प्रस्त पत्र के. Paper No.</td>
<td>II/III/IV/V</td>
</tr>
<tr>
<td>अनिवार्य/ वैकल्पिक Compulsory/ Optional</td>
<td>Optional Gr-IV (I)</td>
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<tbody>
<tr>
<td>Unit-3</td>
<td>Mathematical Formulation, Graphical Solution Method.</td>
</tr>
<tr>
<td>Unit-4</td>
<td>General Linear Programming Problem: Simplex Method exceptional cases, artificial variable techniques; Big M method, two phase Method and Cyclic Problems, problem of degeneracy.</td>
</tr>
<tr>
<td>Unit-5</td>
<td>Duality, Fundamental Properties of duality and theorem of duality.</td>
</tr>
</tbody>
</table>

**Recommended Books :-**
2. S.D. Sharma, Operation Research,
5. G. Hadley, Linear and Dynamic programming, Addison - Wesley Reading Mass.
8. N.S. Kambo, Mathematical Programming Techniques, Affiliated East - West Pvt. Lt