



5. यदि विभाग में स्ववित्तीय योजना के तहत कोई पाठ्यक्रम/अतिरिक्त विषय/डिप्लोमा कोर्स/सर्टिफिकेट कोर्स प्रारंभ करने की योजना हो तो उसका विवरण एवं अनुशंसा।
6. यदि अन्य कोई विषय हो तो उसका विवरण एवं अनुशंसा।

हस्ताक्षर अध्ययन मंडल अध्यक्ष एवं समस्त सदस्य हस्ताक्षर

डा. ओ. पी. मिश्रा : Om  
28.6.2016

डा. एन सी शर्मा : N C Sharma  
28.6.16

डा. के. के. शर्मा : Ke Ke

डा. आर. के. शर्मा : Ar  
28.6.16

डा. बी. पी. सिंह : B P  
28/6/16

डा. एन के. गौतम : N K

डा. डी. पी. अग्रवाल : D P  
28/6/16



**Mathematics**

**List of Examiners ( 2016-2017 )**

S.No.	Name	Address
1.	Dr. N.C. Sharma	Prof. K.R.G. College, Gwalior
2.	Dr. R.K. Sharma	Assistant Prof. K.R.G. College, Gwalior
3.	Dr. K.K. Sharma, Registrar	Assistant Prof. K.R.G. College, Gwalior Music Univ.
4.	Dr. B.B. Singh	Assistant Prof. K.R.G. College, Gwalior
5.	Dr. N.K. Gautam	Assistant Prof. K.R.G. College, Gwalior
6.	Dr. R.K. Shrivastava	Prof. Govt. Science College, Gwalior
7.	Dr. BPS Jadon	Prof. Govt. Science College, Gwalior
8.	Dr. V.K. Gupta	Assistant Prof. Govt. Science College, Gwalior
9.	Dr. K. Kapoor	Assistant Prof. Govt. Science College, Gwalior
10.	Dr. Poonam Sinha	Assistant Prof. Govt. Science College, Gwalior
11.	Dr. (Mrs) Rajya Shri Mishra	Assistant Prof. Govt. Science College, Gwalior
12.	Dr. Prasant Dubey	Assistant Prof. Govt. Science College, Gwalior
13.	Dr. D.P. Agrawal	Assistant Prof. Govt. Science College, Gwalior
14.	Dr. Arun Tripathi	Assistant Prof. Govt. Science College, Gwalior
15.	Dr. H.S. Jatav	Assistant Prof. Govt. Science College, Gwalior
16.	Dr. R.N. Gupta	Prof. Govt. S. L. P College, Gwalior
17.	Dr. Anoop Singh Yadav	Prof. Govt. S. L. P College, Gwalior
18.	Dr. Poonam Varshney	Prof. Govt. S. L. P College, Gwalior
19.	Dr. S. N. Shukla	Prof. Govt. S. L. P College, Gwalior
20.	Dr. M. B. Sharma	Prof. Govt. S. L. P College, Gwalior
21.	Dr. H.P.S. Chauhan	Govt. P.G. College, Morena
22.	Dr. A.V. Vinchurkar	Prof, Girls college, Morar
23.	Dr. P.C. Jatav	Assistant Prof. Girls college, Morar
24.	Dr. Sunil Pathak	P.G.V. College Gwalior
25.	Dr. K.K. Jain	Prof. P.G.V. College Gwalior
26.	Prof. Pradeep Bhargava	Girls college, Shivpuri
27.	Dr.R.K. Shakya	Govt. P.G. College, Shivpuri
28.	Dr. G.D. Vaishya	Assistant Prof. P.G. College, Morena
29.	Dr. Dinesh Kumar Mishra	Assistant Prof. Govt. S. L. P College, Gwalior
30.	Dr. C.S. Yadav	Govt. college, Datia
31.	Dr. M.P. Singh	Govt. M.L.B. college, Gwalior
32.	Dr. V.K. Tiwari	Govt. college, Guna
33.	Dr. R.S. Chandel	Prof. Govt. College Geetanjali, Bhopal
34.	Dr. S.K. Malhotra	Prof. Vyapam , Bhopal
35.	Dr. Uday Dolas	Prof. Govt. P.G. College, shihor (M.P.)
36.	Dr. M.S. Rathore	Prof. Govt. College, shihor (M.P.)
37.	Dr. Narendra Kushwah	Assistant Prof. Govt. M.J.S. College, Bhind
38.	Dr. M. Kaushal	Assistant Prof. M.J.S. College, Bhind
39.	Dr. Pandey	Prof. Maharaja college , Chhatarpur (M.P.)
40.	Dr. Santosh Sharma	Prof. I.T.M. college, Gwalior
41.	Dr. Kuwar singh	Lecturer in Maths, Sagar University sagar
42.	Dr. Renu Jain	Prof. S.O.S. Jiwaji University , Gwalior (M.P.)



शासकीय कमलाराजा कन्या स्नातकोत्तर विश्वविद्यालय ग्वालियर (म.प्र.)  
उच्च शिक्षा विभाग म.प्र. शासन  
स्नातक स्तर पर सेमेस्टर पद्धति के अन्तर्गत एकल प्रश्न पत्र प्रणाली अनुसार पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल द्वारा अनुमोदित तथा म.प्र. के महामहिम राज्यपाल द्वारा अनुमोदित

Department of Higher Education, Govt. of M.P.  
Single Paper Pattern Syllabus for U.G. Classes Under Semester System  
As recommended by Central Board of Studies and approved by the  
Governor of M.P.  
Scheme of Examination  
Session- 2015-16 / 16-17  
B.Sc./ B.A. I Semester

Recommended by central Board of studies

Name of the Paper	Theory (M.M.)	Minimum Passing Marks in Theory	C.C.E. (M.M.)	Minimum Passing Marks in C.C.E.	Practical MM	Minimum Passing Marks	Total
Matrix Theory, Calculus, Geometry	125	42	25	8	---	---	150

**Note:** There will be three sections in the question paper. All questions from each section will be compulsory.

**Section -A** (20 marks.) will contain 10 objective type questions, two from each unit, with the weightage of 2 marks.

**Section -B** (35 marks.) will contain 5 short answer type questions (each having internal choice), one from each unit having 7 marks.

**Section -C** (70 marks.) will contain 5 long answer type questions (each having internal choice), one from each unit, having 14 marks.

There should be 12 teaching periods per week for Mathematics like other Science Subject .

(6 Period Theory + 6 Period Practical)

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
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Governor of M.P.

Scheme of Examination

Session- 2015-16 / 16-17

Max. Marks / अधिकतम अंक : 125  
Class/ कक्षा : B.Sc. /B.A.  
Semester/ सेमेस्टर : I  
Subject/ विषय : Mathematics  
Title / शीर्षक : Matrix Theory, Calculus, Geometry

Particulars/ विवरण

Unit-1	Rank of a matrix, Eigen values, eigen vectors, Characteristic equation of a matrix, Cayley Hamilton theorem and its use in finding inverse of matrix, Application of matrix to a system of linear ( both homogenous and non - homogenous) equations, Theorems on consistency and inconsistency of a system of linear equations, Solving the linear equations with three unknowns.
इकाई-1	आव्यूह की जाति, आयगेन मान एवं आयगेन सदिश आव्यूह की चारित्रिकता, केल - हैमिल्टन प्रमेय एवं आव्यूह का व्युत्क्रम ज्ञात करने में इसका उपयोग, रैखिक समीकरणों के निकाय (समघात एवं असमघात) के हल के लिये आव्यूहों का प्रयोग, रैखिक समीकरणों के निकाय की संगतता एवं असंगतता पर प्रमेय, तीन अज्ञात राशियों के रैखिक समीकरणों के हल।
Unit-2	Relation between the roots and coefficients of a general polynomial equation in one variable, Transformation of equations, Descarte's rule of signs, De Moivre's theorem and its applications, Direct and inverse circular and hyperbolic functions, Expansion of trigonometrical function.
इकाई-2	एक चर के सामान्य बहुपदों के समीकरण के गुणांकों एवं मूलों के बीच संबंध, समीकरणों का रूपांतरण, चिन्हों का दिकार्ते नियम, डी-मॉवर्स प्रमेय एवं इसके उपयोग, प्रत्यक्ष एवं व्युत्क्रम, वृत्तीय एवं अतिपरवलयीय फलन, त्रिकोणमितीय फलनों का विस्तार।
Unit-3	Continuity of function of one variable, Properties of continuous

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	function, Uniform continuity, Chain Rule of differentiability, Mean value theorems and their geometrical interpretations, Darboux's Intermediate Value Theorem for derivatives.
इकाई-3	एक चर के फलनों का सांतत्य, संतत फलनों के गुणधर्म, एकसमान सातत्य, अवकलनीयता का श्रृंखला का नियम, माध्यमान प्रमेय एवं उनका ज्यामितीय अर्थ, अवकलन के लिए डॉरबाक्स का माध्यमान प्रमेय ।
Unit-4	Integration of irrational algebraic functions and transcendental functions, Reduction formulae, Definite Integrals.
इकाई-4	अपरिमेय , बीजीय एवं अवीजीय फलनों का समाकलन। समानयन सूत्र । निश्चित समाकलन।
Unit-5	Equation of cone with given base, generators of cone, condition for three mutually perpendicular generators, Right circular cone, Equation of Cylinder and its properties, Right circular cylinder, enveloping cylinder and their properties.
इकाई-5	दिए गए आधार के शंकु का समीकरण, शंकु के जनक, तीन परस्पर लम्बवत् जनकों हेतु शर्त, लंबवृत्तीय शंकु बेलन का समीकरण एवं उसके गुणधर्म, लंबवृत्तीय बेलन, अन्वलोपिय बेलन एवं उसके गुणधर्म।

### Texts Books :

1. S.L. Loney – Plane Trigonometry Part II
2. K.B. Datta – Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000
3. Chandrika Prasad – A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd. Allahabad
4. N. Saran & R.S. Gupta : Analytical Geometry of Three dimensions. Pothishala Pvt. Ltd. Allahabad
5. S.L. Loney, Elements of Coordinate Geometry, Macmillan and Co. London.
6. Gorakh Prasad – Differential Calculus, Pothishala pvt. Ltd. Allahabad
7. Gorakh Prasad – Integral Calculus, Pothishala pvt. Ltd. Allahabad
8. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & sons, 1999.

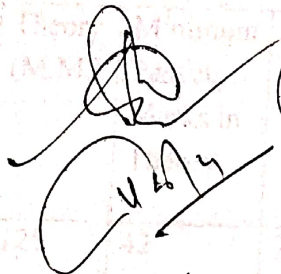
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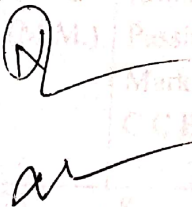


**Reference Books:**

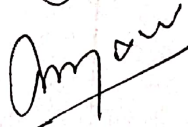
1. P. B. Bhattacharya, S. K. Jain and S.R. Nagpaul, First Courses in Linear Algebra, Wiley Eastern, New Delhi. 1983.
2. R.S. Verma and K.S. Shukla, Text Book on Trigonometry Pothishala Pvt. Ltd.
3. P.K. Jain & Khalil Ahmad, A text book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999
4. R.J.T. Bell : Elementary Treatise on Coordinate Geometry of Three dimensions, Macmillan India Ltd. 1994.
5. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
6. H.S. Hall and S.R. Knight, Higher Algebra, H.M. publication, 1994.
7. म.प्र. हिन्दी ग्रंथ अकादमी की पुस्तकें ।

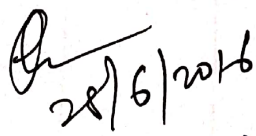
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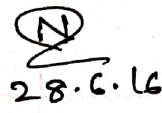




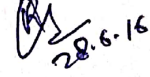


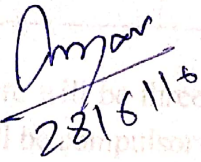


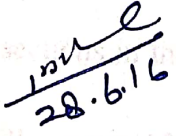


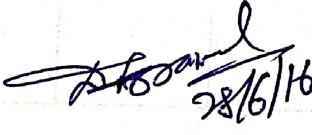


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Section - A (20 marks) will contain 10 objective type questions, 2 from each unit, with the weightage of 2 marks.

Section - B (25 marks) will contain 5 short answer type questions (each having internal choice), one from each unit having 7 marks.

Section - C (20 marks) will contain 3 long answer type questions (each having internal choice), one from each unit, having 14 marks.

There should be 12 teaching periods per week for Mathematics like other Science Subject (6 Period Theory + 6 Period Practical)







शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
उच्च शिक्षा विभाग म.प्र. शासन  
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Single Paper Pattern Syllabus for U.G. Classes Under Semester System  
As recommended by Central Board of Studies and approved by the  
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Scheme of Examination  
Session- 2016-17

Max. Marks / अधिकतम अंक : 125  
Class/ कक्षा : B.Sc. /B.A.  
Semester/ सेमेस्टर : II  
Subject/ विषय : Mathematics  
Title / शीर्षक : Advanced Calculus, Differential Equations,  
Vector Calculus

Particulars/ विवरण

Unit-1	Successive differentiation, Leibnitz theorem, Maclaurin and Taylor series expansions, Asymptotes, Curvature, Tests for concavity and convexity, Points of inflexion, Multiple points, Tracing of curves in Cartesian co-ordinates.
इकाई-1	उत्तरोत्तर अवकलन, लैबनीज का प्रमेय, मैकलारिन एवं टेलर श्रेणी में विस्तार, अनंत स्पर्शी, वक्रता, उत्तलता एवं अवतलता के परीक्षण, नती परिवर्तन बिन्दु, बहुबिन्दु, कार्तीय निर्देशांको में वक्रों का अनुरेखण ।
Unit-2	Limit and continuity of functions of two variables, Introduction of Partial differentiation, Euler's Theorem on homogeneous function, Jacobians, Differentiability of real-valued functions of two variables, Taylor's theorem for functions of two variables, Double and triple integrals, Dirichlet's integrals.
इकाई-2	दो चरों के फलनों की सीमा एवं सांतत्य, आंशिक अवकलन की अवधारणा, समघात फलनों पर आयलर का प्रमेय, जेकोबियन, दो चरों के वास्तविक मान फलनों के आंशिक अवकलज एवं अवकलनीयता, दो चरों के फलनों के लिए टेलर का प्रमेय, द्विशः एवं त्रि-समाकलन, डिरिक्ले का समाकल ।
Unit-3	Linear Differential equations and equations reducible to the linear

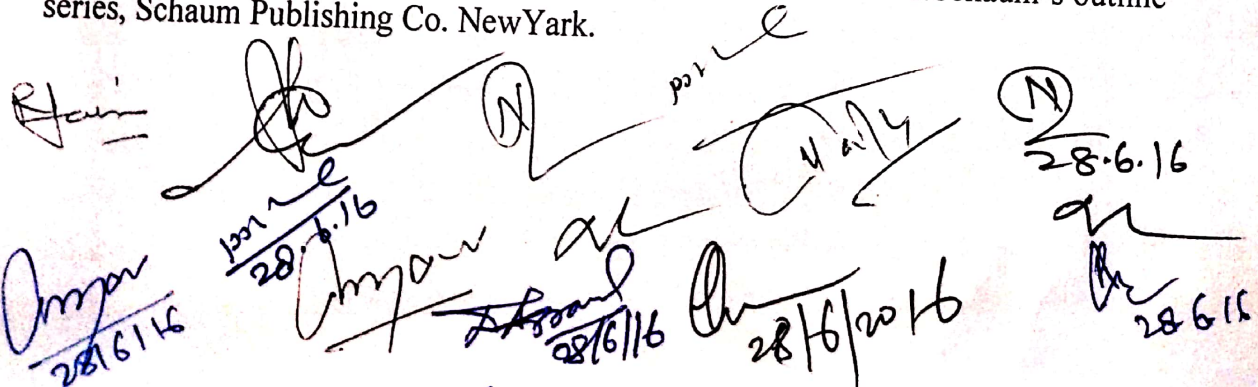
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	form, Exact differential equation, First order and higher degree equations Solvable for x, y and p, Clairaut's form and singular solutions, Linear differential equations with constant coefficients.
इकाई-3	रैखिक अवकल समीकरण, रैखिक समीकरणों में रूपांतरणीय समीकरण, यथातथ अवकल समीकरण, x, y और p में हल होने वाले प्रथम कोटि एवं उच्चघात के समीकरण, क्लारेट फार्म एवं विचित्र हल, अचर गुणांको के रैखिक अवकल समीकरण।
Unit-4	Homogenous linear ordinary differential equations, linear differential equations of second order, Transformation of the equation by changing the dependent variable and the independent variable, Method of variation of parameters, Ordinary simultaneous differential equations.
इकाई-4	सामान्य समघात रैखिक अवकल समीकरण, द्विघात रैखिक अवकल समीकरण, परतंत्र एवं स्वतंत्र चरों को बदल कर समीकरण का रूपांतरण। प्राचल विचरण की विधि, साधारण युगपद अवकल समीकरण।
Unit-5	Vector differentiation, Gradient, Divergence and Curl, Vector integration, Theorem of Gauss (without proof) and problems based on it, Theorem of Green (without proof) and problems based on it, Stoke's theorem (without proof) and problems based on it.
इकाई-5	सदिश अवकलन, ग्रेडियंट, डायवर्जेंस एवं कर्ल, सदिश समाकलन, गॉस की प्रमेय (बिना उपपत्ति) एवं उस पर आधारित प्रश्न, ग्रीन का प्रमेय (बिना उपपत्ति) एवं उस पर आधारित प्रश्न, स्टोक का प्रमेय (बिना उपपत्ति) एवं उस पर आधारित प्रश्न।

### Texts Books :

1. Gorakh Prasad – Differential Calculus, Pothishala pvt. Ltd. Allahabad
2. Gorakh Prasad – Integral Calculus, Pothishala pvt. Ltd. Allahabad
3. D.A. Murray : Introductory Course in Differential Equations, Orient Long man, India 1967.
4. N. Saran & S.N. Nigam – Introduction to Vector Analyss, Pothishala Pvt. Ltd., Allahabad.
5. Murray R. Spiegel, Theory & problems of Advanced Calculus. Schaum's outline series, Schaum Publishing Co. NewYark.


 A collection of handwritten signatures and dates. The signatures are written in black ink and are somewhat stylized. The dates are written in black ink and include "28/6/16" and "28/6/2016". There are also some circled numbers and other markings.







शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
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**Department of Higher Education, Govt. of M.P.**  
**Single Paper Pattern Syllabus for U.G. Classes Under Semester System**  
**As recommended by Central Board of Studies and approved by the**  
**Governor of M.P.**  
**Scheme of Examination**  
**Session- 2017-18**  
**B.Sc./B.A. III Semester**

Recommended by central Board of studies

Name of the Paper	Theory (M.M.)	Minimum Passing Marks in Theory	C.C.E. (M.M.)	Minimum Passing Marks in C.C.E.	Practical MM	Minimum Passing Marks	Total
Real Analysis, Differential Equation, Abstract Algebra	125	42	25	8	---	---	150

**Note:** There will be three sections in the question paper. All questions from each section will be compulsory.

**Section –A** (20 marks.) will contain 10 objective type questions, two from each unit, with the weightage of 2 marks.

**Section –B** (35 marks.) will contain 5 short answer type questions (each having internal choice), one from each unit having 7 marks.

**Section –C** (70 marks.) will contain 5 long answer type questions (each having internal choice), one from each unit, having 14 marks.

There should be 12 teaching periods per week for Mathematics like other Science Subject:

(6 Period Theory + 6 Period Practical)

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
उच्च शिक्षा विभाग म.प्र. शासन  
स्नातक स्तर पर सेमेस्टर पद्धति के अन्तर्गत एकल प्रश्न पत्र प्रणाली अनुसार पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के महामहिम राज्यपाल द्वारा अनुमोदित  
Department of Higher Education, Govt. of M.P.  
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Scheme of Examination  
Session- 2017-18

Max. Marks / अधिकतम अंक : 125  
Class/ कक्षा : B.Sc. /B.A.  
Semester/ सेमेस्टर : III  
Subject/ विषय : Mathematics  
Title / शीर्षक :  Real Analysis, Differential Equation,  
 Abstract Algebra

Particulars/ विवरण

Unit-1	Definition of a sequence, Theorems on limits of sequences, Bounded and monotonic sequences, Cauchy's convergence criterion, Series of non-negative terms, Comparison test, Cauchy's integral test, Ratio test, Raabe's test, logarithmic test, Leibnitz's theorem, Absolute and conditional convergence.
इकाई-1	अनुक्रम की परिभाषा, अनुक्रमों की सीमाओं पर प्रमेय, परिबद्ध एवं एकदिष्ट अनुक्रम, कॉशी के अभिसरण का मापदंड, अक्रणात्मक पदों की श्रेणी, तुलना परीक्षण, कॉशी का समाकल परीक्षण, अनुपात परीक्षण, रॉबी का परीक्षण, लघुगणकीय परीक्षण, लिबनीज का प्रमेय, निरपेक्ष एवं सापेक्ष अभिसरण।
Unit-2	Series Solution of Differential Equations-Power series Method, Bessel's Equation, Bessel's function and its properties, recurrence and generating relations, Legendre's Equation, Legendre's function and its properties, recurrence and generating relations.
इकाई-2	अवकल समीकरणों की श्रेणी हल, घात-श्रेणी विधि, बेसल का समीकरण, बेसल का फलन एवं उसके गुणधर्म, पुनरागमन एवं जनक संबंध, लीजेन्डर का समीकरण, लीजेन्डर का फलन एवं उसके गुणधर्म, पुनरागमन एवं जनक संबंध।

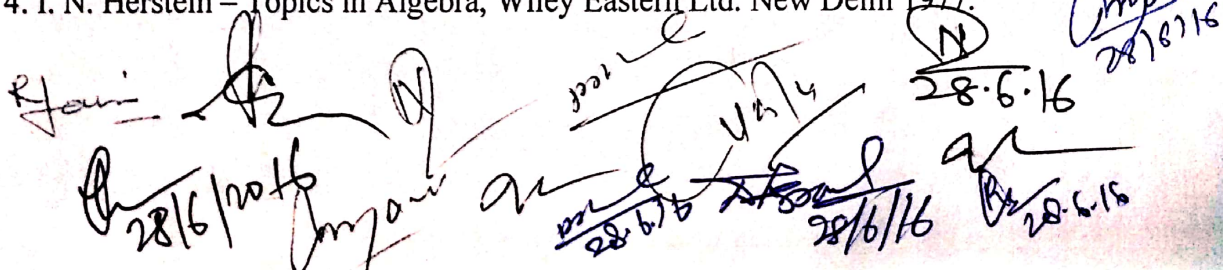
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Unit-3	Laplace transformations, Linearity of the Laplace transformation, Existence theorem of Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorem, Differentiation and integration of transforms, Inverse Laplace transforms, Convolution theorem, Applications of Laplace transformation in solving linear differential equations with constant coefficients.
इकाई-3	लाप्लास रूपांतरण, लाप्लास रूपांतरणों की लांबिकता, लाप्लास रूपांतरणों का अस्तित्व प्रमेय, अवकलों एवं समाकलों के लाप्लास रूपांतरण, स्थानांतरण प्रमेय, रूपांतरणों का अवकलन एवं समाकलन, प्रतिलोम लाप्लास रूपांतरण, सवलन प्रमेय, अचर गुणांकों वाले रैखिक अवकल समीकरणों को हल करने में लाप्लास रूपांतरणों के अनुप्रयोग।
Unit-4	Definition and basic properties of group, Order of an element of a group, Subgroups, Algebra of subgroups, Cyclic groups and their simple properties, Coset decomposition and related theorems, Lagrange's theorem and its consequences.
इकाई-4	समूह की परिभाषा एवं मूलभूत गुणधर्म, समूह के अवयव की कोटि, उप समूह, उपसमूहों का बीजगणित। चक्रीय समूह एवं उनके साधारण गुणधर्म, सह समुच्चय विभाजन एवं संबंधित प्रमेय, लेग्रान्जे प्रमेय एवं उसके निगमन।
Unit-5	Normal sub group, Quotient groups, homomorphism and isomorphism of groups, Kernel of homomorphism of groups, fundamental theorem of homomorphism of groups, Permutation groups ( even and odd permutations), Alternating groups $A_n$ , Cayley's theorem.
इकाई-5	प्रसामान्य उप समूह, विभाग समूह, समूहों की समकारिता एवं तुल्यकारिता, समकारिता की अष्टि, समूहों की समकारिता का मूलभूत प्रमेय, क्रमचय समूह (सम एवं विषम क्रमचय) एकांतर समूह $A_n$ , कैली का प्रमेय।

#### Text Books :

1. R.R. Goldberg, Real Analysis, I.B.H. Publishing Co. New Delhi, 1970.
2. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd. Allahabad.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & sons, 1999.
4. I. N. Herstein – Topics in Algebra, Wiley Eastern Ltd. New Delhi 1977.


 The bottom section of the page contains several handwritten signatures and dates. On the left, there is a signature that appears to be 'Rajni' with a date '28/6/16'. In the center, there is a signature with a date '28/6/16'. On the right, there is a signature with a date '28.6.16' and another signature with a date '28.6.16'. There are also some other handwritten marks and initials scattered around.



5. Sharma and Gupta-Integral Transform, Pragati Prakashan Meerut
6. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

**Reference Books:**

1. T.M. Apostol Mathematical Analysis Narosa Publishing House New Delhi 1985.
2. Murray R.Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co. New York.
3. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
4. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd. New Delhi.
5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Wiley Eastern, New Delhi, 1997.
6. I. S. L.uther and I.B. S. Passi, Alegebra Vol- I , II, Narosa Publishing House.

*Handwritten signatures and initials:*  
 Jain, A, N, and a signature with "4/2/16" written below it.

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 Ambar, a signature, and a date "28/6/16".

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
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Department of Higher Education, Govt. of M.P.  
Single Paper Pattern Syllabus for U.G. Classes Under Semester System  
As recommended by Central Board of Studies and approved by the Governor of M.P.  
Scheme of Examination

Session- 2016-17

B.Sc./ B.A. IV Semester

Recommended by central Board of studies

Name of the Paper	Theory (M.M.)	Minimum Passing Marks in Theory	C.C.E. (M.M.)	Minimum Passing Marks in C.C.E.	Practical MM	Minimum Passing Marks	Total
Abstract Algebra, Advanced Calculus, Partial Differential Equations, Complex Analysis	125	42	25	8	---	---	150

**Note:** There will be three sections in the question paper. All questions from each section will be compulsory.

**Section –A** (20 marks.) will contain 10 objective type questions, two from each unit, with the weightage of 2 marks.

**Section –B** (35 marks.) will contain 5 short answer type questions (each having internal choice), one from each unit having 7 marks.

**Section –C** (70 marks.) will contain 5 long answer type questions (each having internal choice), one from each unit, having 14 marks.

There should be 12 teaching periods per week for Mathematics like other Science Subject .

(6 Period Theory + 6 Period Practical)

Handwritten signatures and dates: 28/6/16, 28.6.16, 28/6/2016, 28.6.16



शासकीय कर्मसाराज्वा कक्षा स्नातकोत्तर स्तरासी महाविद्यालय ग्वालिअर (म.प.)  
उच्च शिक्षा विभाग म.प. शासन  
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Department of Higher Education, Govt. of M.P.  
Single Paper Pattern Syllabus for U.G. Classes Under Semester System  
As recommended by Central Board of Studies and approved by the Governor of M.P.  
Scheme of Examination  
Session- 2016-17

Max. Marks / अधिकतम अंक : 125  
Class/ कक्षा : B.Sc. /B.A.  
Semester/ सेमेस्टर : IV  
Subject/ विषय : Mathematics  
Title / शीर्षक : Abstract Algebra, Advanced Calculus,  
Partial Differential Equations, Complex  
Analysis

Particulars/ विवरण

Unit-1	Group automorphisms, inner automorphism, Group of automorphisms, Conjugacy relation and centraliser, Normaliser, Counting principle and the class equation of a finite group, Cauchy's theorem for finite abelian groups and non-abelian groups.
इकाई-1	समूह स्वकारिता (स्वसमरूपता), आंतर स्वकारिता, स्वकारिताओं का समूह, संयुग्मता संबंध एवं केन्द्रीयकारक, प्रसामान्यक, गणना सिद्धांत एवं परिमित समूह का वर्ग समीकरण। परिमित आबेली एवं अन-आबेली समूहों के लिये कौशी प्रमेय।
Unit-2	Introduction to rings, subrings, integral domains and fields, simple properties and examples, ring homomorphism, ideals and quotient rings.
इकाई-2	वलय, उपवलय, पूर्णांकीय प्रांत एवं क्षेत्र का परिचय सरल गुणधर्म एवं उदाहरण, वलय समाकारिता, गुणजावली एवं विभाग वलय।
Unit-3	Maxima, Minima and saddle points of functions of two variables, Improper integrals and their convergence, Comparison test, Abel's and Dirichlet's tests, Beta and Gamma functions.

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इकाई-3	दो चरों के फलनों का उच्चिष्ठ, निम्निष्ठ एवं सेडल बिन्दु, विषम समाकल एवं उनका अभिसरण, तुलना परीक्षण, आबेल एवं डिरिक्ले का परीक्षण, बीटा एवं गामा फलन।
Unit-4	Partial Differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than general methods, Charpit's general method of solution, Partial differential equations of second and higher orders, Homogeneous and non-Homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients.
इकाई-4	प्रथम कोटि के आंशिक अवकल समीकरण, लेग्रान्जें का हल, कुछ विशिष्ट प्रकार के समीकरण जिन्हें व्यापक विधि के अलावा सरल विधि से हल किया जा सके, हल के लिए चारपिट की व्यापक विधि, द्वितीय एवं उच्चतर कोटि के आंशिक अवकल समीकरण, अचर गुणांकों के समघातीय एवं असमघातीय समीकरण, आंशिक अवकल समीकरण जो अचर गुणांकों वाले समीकरणों में परिवर्तनीय है।
Unit-5	Continuity and differentiability of Complex functions, Analytical function, Cauchy Riemann equation, Harmonic function, Mobius transformations, fixed points, cross ratio.
इकाई-5	सम्मिश्र फलनों का सांतत्य एवं अवकलनीयता। वैश्लेषिक फलन, कौशी रीमान समीकरण, प्रसंवादी फलन, मोबियस रूपांतरण, स्थिर बिन्दु, तिर्यक अनुपात।

**Text Books :**

1. I.N. Sneddon, Elements of partial Differential equations Mc graw Hill, Co. 1988
2. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.
3. I.N. Herstein Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1977.
4. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York
5. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

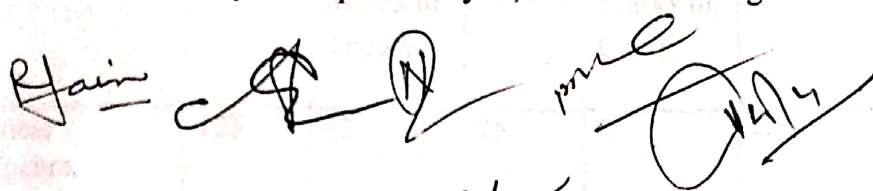
**Reference Books:**

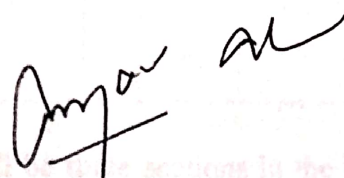
1. T.M. Apostol, Mathematical Analysis Narosa Publishing House, New Delhi 1985
2. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.

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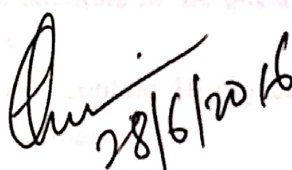


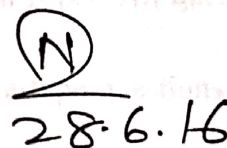
3. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
4. N. Jacobson, Basis Algebra, Vols, I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company.)
5. Shanti Narayan, A Text Book of Modern Abstract Algebra, S. Chand & Co. New Delhi
6. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Wiley Eastern, New Delhi, 1997.
7. I. S. L. uther and I.B. S. Passi, Algebra Vol- I , II, Narosa Publishing House.
8. R. V. Churchill & J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw-Hili New. York. 1990
9. Mark; J. Ablowitz & A. S. Fokas. Complex Variables : Introduction and Applications, Cambridge University Press, South Asian Edition, 1998
10. Ponnuswamy : Complex Analysis, Narosa Publishing Co.

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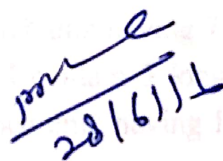
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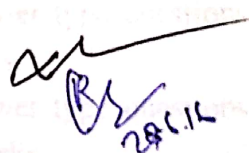
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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
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**Department of Higher Education, Govt. of M.P.**  
**Single Paper Pattern Syllabus for U.G. Classes Under Semester System**  
**As recommended by Central Board of Studies and approved by the Governor of M.P.**  
**Scheme of Examination**  
**Session- 2017-18**  
**B.Sc./ B.A. V Semester**

Recommended by central Board of studies

Name of the Paper	Theory (M.M.)	Minimum Passing Marks in Theory	C.C.E. (M.M.)	Minimum Passing Marks in C.C.E.	Practical MM	Minimum Passing Marks	Total
Linear Algebra, Numerical Analysis	125	42	25	8	---	---	150

**Note:** There will be three sections in the question paper. All questions from each section will be compulsory.

**Section –A** (20 marks.) will contain 10 objective type questions, two from each unit, with the weightage of 2 marks.

**Section –B** (35 marks.) will contain 5 short answer type questions (each having internal choice), one from each unit having 7 marks.

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There should be 12 teaching periods per week for Mathematics like other Science Subject.

(6 Period Theory + 6 Period Practical)

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.,  
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Department of Higher Education, Govt. of M.P.  
Single Paper Pattern Syllabus for U.G. Classes Under Semester System  
As recommended by Central Board of Studies and approved by the Governor of M.P.  
Scheme of Examination

Session- 2017-18

Effective from Session 2016 -17

Max. Marks / अधिकतम अंक : 125  
Class/ कक्षा : B.Sc. /B.A.  
Semester/ सेमेस्टर : V  
Subject/ विषय : Mathematics  
Title / शीर्षक : Linear Algebra, Numerical Analysis

Note: Scientific Calculator will be allowed in the examination of this paper.

Particulars/ विवरण

Unit-1	Definition and examples of vector spaces, subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic properties, Basis, Finite dimensional vector spaces, Existence theorem for basis, Invariance of the number of elements of a basis set, Dimension, Dimension of sums of vector subspaces.
इकाई-1	सदिश समष्टि की परिभाषा एवं उदाहरण, उपसमष्टि, उपसमष्टियों का योग एवं सीधा योग, रैखिक विस्तृति, रैखिक आश्रितता, स्वतंत्रता एवं उनके मूल गुणधर्म, आधार, परिमित विमीय सदिश समष्टियाँ, आधार का अस्तित्व प्रमेय, आधार समुच्चय में अवयवों की संख्या की अपरिवर्तनशीलता, विमा, सदिश उपसमष्टियों के योग की विमा।
Unit-2	Linear transformations and their representation as matrices, The algebra of linear transformations, The rank- nullity theorem, Eigen values and eigen vectors of a linear transformation, Diagonalisation, Quotient space and its dimension.
इकाई-2	रैखिक रूपांतरण एवं उनका आव्यूह निरूपण, रैखिक रूपांतरणों का बीजगणित, जाति शून्यता प्रमेय, रैखिक रूपांतरणों के आयगन मान एवं आयगन सदिश, विकर्णीकरण, विभाग समष्टि एवं उसकी विमा।

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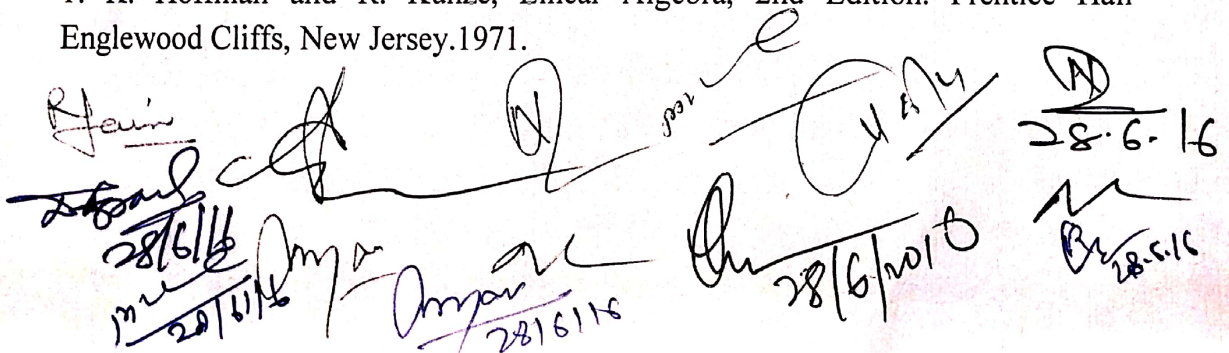




Unit-3	Approximations, Errors and its types, Solution of Equations: Bisection, Secant, Regula Falsi, Newton- Raphson Method and their order of convergence, Roots of second degree Polynomials, Interpolation: Lagrange interpolation, Divided Differences, Interpolation formulae using Differences and derivations of Interpolation formula.
इकाई-3	सन्निकटन, त्रुटियाँ एवं उसके प्रकार, समीकरणों के हल: द्विभाजन, सीकेन्ट, रेग्युला फाल्सी तथा न्युटन-रॉफ्सन विधि एवं उसकी अभिविन्दुता की कोटि, द्वितीय घात बहुपदों के मूल। अर्न्तवशन: लेग्रांजें अर्न्तवशन, विभाजित अन्तर, अन्तर के उपयोग से अर्न्तवशन सूत्र एवं अर्न्तवशन सूत्रों की उत्पत्ति ।
Unit-4	Linear Equations: Direct Methods for Solving Systems of Linear Equations, Gauss elimination, Gauss Jordan Method, LU Decomposition, Cholesky Decomposition, Iterative Methods: Jacobi Method , Gauss - Seidel Method, Relaxation Method, Methods Based on Numerical Differentiation.
इकाई-4	रैखिक समीकरण : रैखिक समीकरणों के निकाय को हल करने की प्रत्यक्ष विधियां ; गाउस विलोपन, गाउस जार्डन विधि, एल यू वियोजन, चोलेस्की वियोजनद्ध, पुनरावृत्ती विधियां ; जेकोबी विधि, गाउस सिडेल विधि, रिलेक्सेशन विधि, संख्यात्मक अवकलन पर आधारित विधियां ।
Unit-5	Ordinary Differential Equations: Euler Method, Eulers Modified Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods, Milne Method, Numerical Quadrature, Newton-Cote's Formulae, Gauss Quadrature Formulae, Methods Based on Numerical Integration with their derivation.
इकाई-5	साधारण अवकल समीकरण: आयलर विधि, आयलर संशोधित विधि, एकल चरण विधि, रूंग -कुटटा विधि, बहुचरण विधि, मिलने विधि, संख्यात्मक क्षेत्रकलन, न्युटन कोट्स सूत्र , गाउस क्षेत्रकलन सूत्र , संख्यात्मक समाकलन पर आधारित विधियाँ एवं उनकी उत्पत्ति ।

**Text Books :**

1. K. Hoffman and R. Kunze, Linear Algebra, 2nd Edition. Prentice Hall Englewood Cliffs, New Jersey.1971.


 The bottom section of the page contains several handwritten signatures and dates. On the left, there are signatures of 'Hain' and 'S. K. S.' with dates '28/6/16' and '28/6/16'. In the center, there is a signature of 'Anjan' with the date '28/6/16'. To the right, there are more signatures, including one that looks like 'S. K. S.' with the date '28/6/16'. On the far right, there is a date '28.6.16' and a signature 'B. S. S.' with the date '28.5.16'.







शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)  
 उच्च शिक्षा विभाग म.प्र. शासन  
 स्नातक स्तर पर सेमेस्टर पद्धति के अन्तर्गत एकल प्रश्न पत्र प्रणाली अनुसार पाठ्यक्रम  
 केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के महामहिम राज्यपाल द्वारा अनुमोदित  
**Department of Higher Education, Govt. of M.P.**  
**Single Paper Pattern Syllabus for U.G. Classes Under Semester System**  
 As recommended by Central Board of Studies and approved by the Governor of M.P.  
**Scheme of Examination**  
 Session- 2017-18  
 Recommended by central Board of studies

Name of the Paper	Theory (M.M.)	Minimum Passing Marks in Theory	C.C.E. (M.M.)	Minimum Passing Marks in C.C.E.	Practical MM	Minimum Passing Marks	Total
Real Analysis, Discrete Mathematics and Optionals	125	42	25	8	---	---	150

**Note:** There will be three sections in the question paper. All questions from each section will be compulsory.

**Section –A** (20 marks.) will contain 10 objective type questions, two from each unit, with the weightage of 2 marks.

**Section –B** (35 marks.) will contain 5 short answer type questions (each having internal choice), one from each unit having 7 marks.

**Section –C** (70 marks.) will contain 5 long answer type questions (each having internal choice), one from each unit, having 14 marks.

There should be 12 teaching periods per week for Mathematics like other Science Subject .

(6 Period Theory + 6 Period Practical)

**Optional unit should be different from the main subject/paper studied during Semester I to Semester VI.**

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालि  
उच्च शिक्षा विभाग म.प्र. शासन

स्नातक स्तर पर सेमेस्टर पद्धति के अन्तर्गत एकल प्रश्न पत्र प्रणाली अनु  
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के महामहिम राज्यपाल

Department of Higher Education, Govt. of M

Single Paper Pattern Syllabus for U.G. Classes Under Semester System

As recommended by Central Board of Studies and approved by the Governor of M.P.

Scheme of Examination

Session- 2017-18

Max. Marks / अधिकतम अंक : 125  
Class/ कक्षा : B.Sc. /B.A.  
Semester/ सेमेस्टर : VI  
Subject/ विषय : Mathematics  
Title / शीर्षक : Real Analysis, Discrete Mathematics and  
Optional  
Compulsory / अनिवार्य या Optional : Compulsory/Optional

Particulars/ विवरण

Unit-1	Riemann integral, Algebra of Riemann integrable functions, Integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorems of integral calculus
इकाई-1	रीमान समाकल, रीमान समाकलनीय फलनों का बीज गणित, सतत एवं एकदिष्ट फलनों की समाकलनीयता, समाकलन का मूल भूत प्रमेय, समाकलनों के माध्यमान प्रमेय ।
Unit-2	Definition and examples of metric spaces, Neighbourhoods, Limit points, Interior points, Open and closed sets, Closure and interior, Boundary points, Subspace of a metric space, Cauchy sequences, Completeness, Cantor's intersection theorem, Contraction principle, Real numbers as a complete ordered field, Definition of Continuous functions and its illustrations.
इकाई-2	दूरीक समष्टि की परिभाषा एवं उदाहरण, सामीप्य, सीमा बिन्दु, अंत : बिन्दु, विवृत्त एवं संवृत समुच्चय, संवरणक एवं अभ्यंतर, परिसीमा बिन्दु, दूरीक समष्टि की उप समष्टि, कौशी अनुक्रम, पूर्णता, केन्टर का सर्वनिष्ठ प्रमेय, संकुचन सिद्धांत, पूर्ण कमित क्षेत्र के रूप में वास्तविक संख्याएँ, सतत फलन की परिभाषा एवं उसके उदाहरण ।

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Unit-3	Algebra of Logic, Tautologies and Contradictions, logical equivalence, Algebra of propositions, Quantifiers: Universal and Existential Quantifiers, Boolean Algebra and its properties, Demorgan's law, Algebra of Electric circuits and its applications.
इकाई-3	तर्क का बीज गणित, पुनरुक्तियों तथा विरोध का पुनरावलोकन, तार्किक तुल्यता, साध्यों का बीजगणित, प्रमात्रीकारक: आस्तित्व प्रमात्रीकारक एवं सर्व प्रमात्रीकारक, बूलीय बीजगणित एवं उसके गुणधर्म, डी-मार्गन नियम, वैद्युत परिपथों का बीजगणित एवं उनके अनुप्रयोग ।
Unit-4	Boolean Function, Disjunction and Conjunction Normal Forms, Boole's Expansion Theorem. Binary Relations, Equivalence Relations, Partitions and Partial Order Relation.
इकाई-4	बूलीय फलन, वियोजनीय एवं संयोजनीय प्रसामान्य रूप, बूल का प्रसार प्रमेय द्विचर संबंध, तुल्यता संबंध, विभाजन एवं आंशिक क्रम संबंध।
Optional	
This unit should be different from the main subject/paper studied during Semester I to Semester VI.	
Graph Theory	
Unit-5	Graphs, Multigraphs, Weighted Graphs, Paths and Circuits, Shortest Paths: Dijkstra's Algorithm, Matrix Representation of Graph: Incidence and Adjacency Matrix, Trees and its simple properties.
इकाई-5	ग्राफ, बहुग्राफ, भारित ग्राफ, पथ एवं परिपथ, लघुतम पथ : डाइज्कस्ट्रा एल्गोरिथम, ग्राफ का आव्यूह निरूपण: इन्सीडेंस एवं एडजेसेन्सी आव्यूह, वृक्ष एवं उसके सामान्य गुणधर्म।
Or/ अथवा	
Elementary Statistics	
Unit-5	Probability, Continuous probability, probability density function and its applications (for finding the mean, mode, median and standard deviation of various continuous probability distributions) Mathematical expectation, expectation of sum and product of random variables, Moment generating functions, Theoretical distribution: Binomial, Poisson distributions and their properties and uses.
इकाई-5	प्रायिकता, सतत प्रायिकता, प्रायिकता घनत्व फलन तथा उनके अनुप्रयोग (सतत प्रायिकता बंटन के लिये माध्य, बहुलक, माध्यिका तथा मानक विचलन ज्ञात करने

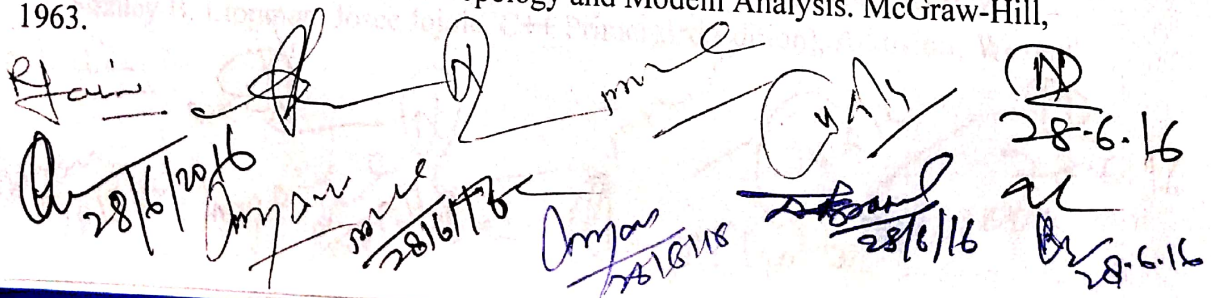
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	के लिये) गणितीय प्रत्याशा, यादृच्छिक घटो के योग एवं गुणन की प्रत्याशा, आघूर्ण जनक फलन, सैद्धांतिक बंटन: द्विपद, पॉयजन बंटन तथा उसके गुणधर्म एवं उपयोग ।
Or/ अथवा	
<b>PRINCIPLES OF COMPUTER SCIENCE</b>	
Unit-5	Data Storage of bits Ram Memory. Mass storage. Coding Information of Storage. The Binary System Storing integers fractions, communication errors. Data Manipulation – The Central Processing Unit The Store Program concept. Programme Execution, Arithmetic/Logic Instruction. Computer-Peripheral Communication. Operation System : The Evolution of Operating System. (Dos, Window) Operating System Architecture. Coordinating the Machine's Activities. Other Architectures.
इकाई-5	बीटों का डेटास्टोरेज , रैम स्मृति। वृहद भण्डारण की कठू कृत सूचना। बायनरी सिस्टम। पूर्णांक, भिन्नांक का भण्डारण, संचारण त्रुटियां डाटा मेन्चूप्लेशन – सेन्ट्रल प्रोसेसिंग यूनिट, भण्डारित प्रोग्राम अभिधारणा। प्रोग्राम का संचालन। गणितीय/तार्किक निर्देश। कम्प्यूटर-सह उपकरण (पेरीफेरल्स) के मध्य संचार। ऑपरेटिंग सिस्टम: का उदभव (Dos, Window) आपरेटिंग सिस्टम आर्किटेक्चर कम्प्यूटर मशीन की गतिविधियों का समन्वयन। अन्य आर्किटेक्चर।
Or/ अथवा	
<b>MATHEMATICAL MODELING</b>	
Unit-5	The process of Applied Mathematics. Setting up first order differential equations. Qualitative solution sketching. Stability of solutions. Difference and differential equation models of growth and decay. Single species population model, Exponential and logistic population models.
इकाई-5	प्रयुक्त गणित की विधि। प्रथम कोटि अवकल समीकरण की स्थापना। गुणात्मक हल चित्रण। हलो का स्थायित्व। अंतर एवं अवकल समीकरण मॉडल विकास एवं श्रय। एकल एपाइसेस पॉपूलेशन मॉडल, एक्सापोनेंशियल एवं लॉजिस्टिक पॉपूलेशन मॉडल्स

**Text Books :**

1. R.R Goldberg, Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970.
2. G.F. Simmons. Introduction to Topology and Modern Analysis. McGraw-Hill, 1963.


  
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3. T.M Apostol, Mathematical Analysis. Narosa Publishing House. New Delhi, 1
4. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science series 1986.
5. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

#### Reference Books:

1. T.M Apostol, Mathematical Analysis. Narosa Publishing House. New Delhi, 1985.
2. S. Lang. Undergraduate Analysis, Springer-Verlag, New York, 1983.
3. D. Somasundaram and B. Choudhary, A first Course in Mathematical Analysis. Narosa Publishing House, New Delhi 1997.
4. Shanti Narayan, A Course of Mathematical Analysis. S. Chand & Co. Delhi.
5. R.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi 2000.
6. P.K. Jain and K. Ahmed Metric Spaces, Narosa Publishing House, New Delhi, 1996.
7. S. Lang, Undergraduate Analysis, Springer-Verlag, New York 1983.
8. E.T. Copson, Metric Spaces, Cambridge University Press, 1968
9. S. Lang. Undergraduate Analysis, Springer-Verlag, New York, 1983.

#### Optional Papers

##### 1. Graph Theory

Text Book:

1. Narsingh Deo : Graph Theory, McGraw Hill.
2. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

##### 2. Elementary Statistics

Text Book:

1. Statistics by M. Ray
2. Mathematical Statistics by J.N Kapoor, H.C Saxena (S. Chand)
3. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

References Book:

1. Fundamentals of Mathematical Statistics, Kapoor and Gupta

##### 3. Principles of Computer Science

Text Book:

1. J. Glen Brookshear, Computer Science: An Overview, Addison- Wesley.
2. Stanley B. Lippman, Josee Jojoie. C++ Primer (3rd Edition), Addison- Wesley

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Total at least ten practicals

3. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

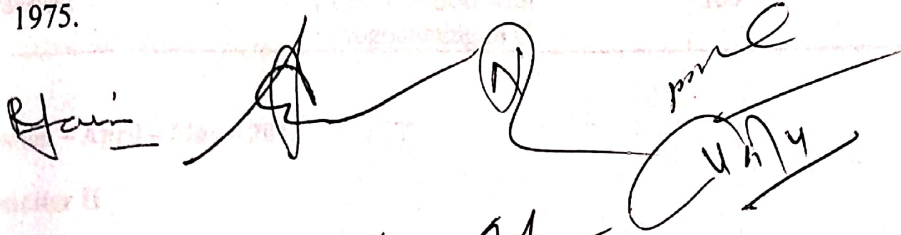
#### 4. Mathematical Modeling

Text Book:

1. Kapoor, J.N. : Mathematical models in Biology and Medicine. EWP (1985)
2. SAXENA V.P. : Bio-Mathematical an introduction, M.P. Hindu Growth Aradamy 1993
3. Martin Braun C.S. Coleman, DA Drew (Eds.) Differential Equation Models.
4. Steven J.B. Lucas W.P., Straffin B.D. (Eds.) Political and Related Models, Vol.2
5. म.प्र हिन्दी ग्रंथ अकादमी की पुस्तकें ।

Reference Book:

1. Cullen Linen Models in Biology.
2. Rubinoe, SI : Introduction yo Mathematical Biology. John Wiley and Sons 1975.

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Misc

Govt. Kamla Raja Girls Post Graduate (Autonomous) College,

Gwalior, M.P.

M.Sc. (Mathematics) Session 2015-16

Scheme

Session- Nov-Dec-2015/2016

Semester I

Paper No.	Paper code and Title	Marks
First Paper	Advanced Abstract Algebra	85 Ext+15 CCE = 100
Second Paper	Analysis	85 Ext+15 CCE = 100
Third Paper	Integral Transform	85 Ext+15 CCE = 100
Fourth Paper	Computer Fundamental and Programming 'c'	85 Ext+15 CCE = 100
Practical	Lab: Practical with Programming In C	100

Session - April - May - 2016 / 2017

Semester II

Paper No.	Paper code and Title	Marks
First Paper	Complex Analysis	85 Ext+15 CCE = 100
Second Paper	Differential Equations	85 Ext+15 CCE = 100
Third Paper	Topology	85 Ext+15 CCE = 100
Fourth Paper	Numerical Methods	85 Ext+15 CCE = 100
Practical	Lab : Practical with Programming In C++	100

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**Govt. Kamla Raja Girls Post Graduate (Autonomous) College,**

**Gwalior, M.P.**

**M.Sc. (Mathematics) Session 2015-16**

and 2016-17

**Scheme**

**Session - Nov-Dec-2015 / 2016**

**Semester III**

Paper No.	Paper code and Title	Marks
First Paper	Functional Analysis	85 Ext+15 CCE = 100
Second Paper	Integral Equations and boundary value problems	85 Ext+15 CCE = 100
Third Paper	Operation/Research	85 Ext+15 CCE = 100
Fourth Paper	Advanced Numerical Methods	85 Ext+15 CCE = 100
Fifth	Practical Lab: Practical based on Numerical Methods	100

**Session - April - May - 2016 / 2017**

**Semester IV**

Paper No.	Paper code and Title	Marks
First Paper	Partial Differential Equations	85 Ext+15 CCE = 100
Second Paper	Advanced Graph Theory	85 Ext+15 CCE = 100
Third Paper	Discrete Mathematical Structures	85 Ext+15 CCE = 100
Fourth Paper	Special Functions	85 Ext+15 CCE = 100
Fifth	Internship / Project	100
Sixth Paper (optional)	Adv. Mathematical Statistics	85 Ext + 15 CCE = 100

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Govt. K.R.G. P.G. (Auto) College, Gwalior

M. Sc. I Semester

Nov-Dec 2015 / 2016

Subject Mathematics

Paper I

Marks- (85, 15)

ADVANCED ABSTRACT ALGEBRA

**Unit- I**

Sylows First, Second and Third theorems, p-sylow Subgroups, Double cosets, conjugate groups, Normal and Subnormal series, Composition series, Jordan Holder theorem, Solvable groups, and commutator subgroups.

**Unit- II**

Modules, Cyclic modules, Simple modules, finitely generated modules, Fundamental structure theorem for finitely generated modules.

**Unit- III**

Field theory, Extension fields, Algebraic Extensions, Roots of polynomials, Simple extension, Splitting fields.

**Unit- IV**

Elements of Galois theory, Fixed Fields, Normal extensions, Group of automorphisms, Galois group, Fundamental theorem of Galois theory.

**Unit- V**

Canonical forms, Similarity of Linear Transformations, Invariant Subspaces, Nilpotent transformations, Reduction of triangular form, Invariants, Jordon blocks & Jordon normal forms.

**Text Books:**

1. Topics in Algebra by I.N. Herstein, Wiley Eastern Ltd. New Delhi, 1975.
2. Basic Abstract Algebra (2<sup>nd</sup> Edition), Cambridge University Press, Indian Edition, 1997.
3. Algebra by M. Artin, Prentice-Hall of India 1991.

**Reference Books:**

1. Algebra by P.M. Cohn, Vols. I, II & III, John Wiley & Sons, 1982, 1989, 1991.
2. Basic Algebra, Vols. I & II by N. Jacobson, W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
3. Galois Theory by J.P. Escofier, GTM, Vol.204, Springer, 2001.
4. Lectures on Modules and Rings by T.Y. Lam, GTM Vol, 1990.

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Govt. K.R.G. P.G. (Auto) College, Gwalior

M. Sc. I Semester  
Subject Mathematics

Nov-Dec 2015 / 2016  
Paper II  
Marks- (85, 15)

ANALYSIS

**Unit- I**

Metric spaces: compact sets, perfect sets, connected sets, Compactness and completeness, limit and continuity of function defined on metric spaces, limits of functions, continuous functions.

**Unit- II**

Continuity and Compactness, continuity and connectedness, monotonic functions: definition and existence of Riemann – Stieltjes integral, properties of the integral, integration and differentiation, the fundamental theorem of calculus, integration of vector-valued functions.

**Unit- III**

Sequence & Series of function point wise & uniform Convergence, Cauchy Criterion for uniform convergence, Weierstrass M- Test uniform Convergence of Series, Uniform Convergence & differentiation, Weierstrass approximation theorem.

**Unit- IV**

Lebesgue outer measure, measurable sets & its properties, Borel set & their measurability, Non-measurable set, measurable functions, characteristics function & simple function.

**Unit- IV**

Lebesgue integral of bounded function over a set of finite measure, Integration of Non-negative function, The general Lebesgue integral, Monotonic Convergence theorem, Lebesgue convergence theorem, Fatou's Lemma.

**Text Books:**

1. Principles of Mathematical Analysis by Walter Rudin.
2. Real Analysis (UNIT IV & V) by H. L. Roydon.

**Reference Books:**

1. Mathematical Analysis by Mullick & Arora, New Age International Publisher.
2. Lebesgue Measure & Integration by Jain & Gupta. New Age International.

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Integral Transforms

**Unit- I**

Laplace Transforms, Properties of Laplace Transforms, Laplace Transform of the derivatives of function, Inverse Laplace transform, Properties of inverse Laplace transform, Inverse Laplace transform of derivatives, convolution theorem, Heaviside's expansion theorem.

**Unit- II**

Application of Laplace Transform to solution of differential equations; solutions of initial value problems, solution of differential equations with constant coefficients, Solution of system of two simultaneous differential equations, Application of Laplace Transform to the solution of integral equations with convolution type kernel.

**Unit- III**

Applications of Laplace Transform to the solution of initial-boundary value problems:- solution of Heat equation, solution of wave equation. Solution of Laplace equation.

**Unit- IV**

Fourier Transforms, Fourier sine transform, Fourier cosine transform, inverse Fourier Transform, Inverse Fourier sine Transform, Inverse Fourier cosine Transform, Properties of Fourier Transforms, Modulation theorem, Convolution theorem, Fourier Transform of the derivatives of functions, Parseval's identity.

**Unit-V**

Application of Fourier Transforms to the solution of initial- boundary value problems:- solutions of Heat equation, solution of diffusion equation, solution of wave equation, solution of Laplace equation.

**Text Books:**

1. Integral Transforms by Vashishtha and Gupta.

**Reference Books:**

1. Integral Transforms by Sneddon.
2. Integral Transforms by Goyal & Gupta

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Govt. K.R.G. P.G. (Auto) College, Gwalior

M. Sc. I Semester

Subject Mathematics

Nov-Dec 2015 / 2016

Paper **IV**

Marks- (85, 15)

**COMPUTER FUNDAMENTAL AND PROGRAMING IN C.**

**UNIT-I**

An overview of functioning of a computer system, Components of a computer system, I/O and auxiliary storage devices, machine and high level languages, assembler compiler and interpreters, flow charts and pseudo codes, Basic concepts of operating system.

**UNIT- II**

Introduction to C Essentials – Programs development, Functions, Anatomy of a function, variable and constants expressions. Assignment Statements, Scalar Data types – Declarations, Different types of integer Constants Floating – point type Initialization, mixing types Explicit conversions – casts Enumeration types the void data type, type definitions.

**UNIT-III**

Operators and expression in C-Precedence and associativity, control flow statements conditional branching, the switch statements, looping, nested loops, the break and continue statement, the go to statement, infinite loops.

**UNIT- IV**

Arrays and multidimensional arrays, storage classes – fixed vs. automatic duration scope, global variable the register specifier, functions – user defined and library function, Introduction to pointers, structures and unions.

**UNIT-V**

Introduction to C++: Declaration & Definition of Variables, Data Types, Operators, OOPS Fundamentals: OOPS Versus procedural programming, OOPS terminology, Data abstraction, Data hiding, Encapsulation, Class, Object, Inheritance, Polymorphism.

**Text Books:**

1. Computer fundamental by Rajaraman
2. Operating systems concepts by Peterson
3. Programming in ANSI C by E. Balaguruswamy, Tata-MCGraw Hill, New Delhi.
4. Programming in C++ by E. Balaguruswamy, Tata-McGraw Hill, New Delhi.
5. Schaum's outline series.

**Reference Books:**

1. Let us C by Y. Kanetkar.
2. Brain W Kernigham & Dennis M Ritchie the C Programmed language 2<sup>nd</sup> edition (ANSI features) Prentice Hall 1989.

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**DIFFERENTIAL EQUATIONS**

**Unit- I**

Preliminaries- Initial value problem and the equivalent integral equation, system of first order ordinary differential equations, concepts of local existence, Existence and uniqueness of solutions of scalar differential Equations, Peano's existence theorem and corollary and scalar case.

**Unit- II**

System of differential equations, Basic Theorems- Ascoli Arzela theorem, a theorem on convergence of solutions of a family of initial value problems. Picard- Lindel of theorem- Peano's existence theorem and corollary for vector.

**Unit- III**

Differential Inequalities and integral inequalities- Gronwall's inequality Maximal and Minimal solutions, Differential inequalities Lower and upper function.

**Unit- IV**

Linear systems of differential equation, characteristic polynomials eigen values, eigen vectors linear homogenous systems and their properties, wronskian, fundamental matrix, Abel-Liouville formula, periodic linear system and Floquet's theorem, Inhomogenous linear systems and variation of constants formula.

**Unit- V**

Poin care- Bendixson Theory- Autonomous systems, Poin care- Bendixson theorem stability of periodic solutions, foci, nodes and saddle points.

Autonomous system of ordinary differential equations, Phase Plane, critical points, stability, Critical Points and Stability of linear systems, Stability by Liapunov's direct method, Lyapunov functions.

**Text Book:**

1. Ordinary Differential Equations by M. Ram Mohana Rao, East- West Press.

**Reference Books:**

1. Ordinary Differential Equations by P. Hartman, John Wiley.
2. Theory of Ordinary Differential Equations by E.A. Coddington and dSN. Levinson, Mc Graw-Hill, Ny.
3. Differential equations with applications and historical note by G.F. Simmons, Tata McGraw Hill.
4. Ordinary differential Equations by W.T. Reid. John Wiley & sons.

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Govt. K.R.G. P.G. (Auto) College, Gwalior

M. Sc. II Semester

Subject Mathematics

Apr 22 - May / 2016-17

Paper III

Marks- (85, 15)

**TOPOLOGY**

**Unit-I**

Topological Spaces: Definition and examples, Open Sets, Closed Sets, Closure neighborhoods, Interior, exterior and boundary, Limit points and derived sets, Basis and Sub basis, Alternate method of defining a topology in terms of Kuratowski Closure operator and Neighborhood systems.

**Unit- II**

Continuous functions and homeomorphism, Count Ability, First and Second countable Spaces, Lindel of theorem, Separable Spaces, Second count ability and Separability, The product and box topology.

**Unit- III**

Connected Spaces, Connected Sets in the real line, Components, Path components, local connectedness, Path connectedness, Local Path connectedness.

**Unit- IV**

Compact Spaces, Lebesgue number lemma, Uniform continuity theorem, Limit point compactness, Local compactness and sequential compactness, one point compactification.

**Unit- V**

Separation axioms, Hausdroff, Regular and Normal Spaces, The Urysohn lemma, Tietze extension theorem, The Uryshon metrization theorem, Completely regular spaces.

**Text Books:**

1. Introduction to Topology and Modern Analysis by G.F. Simonons McGraw Hill Book Co.

**Reference Book:**

1. Topology a first course by James R Munkres, Prentice Hall of India, Pvt. Ltd. New Delhi 2000.
2. General Topology by J.L. Kelley, Van Nostrand, Reinhold Co. New York.

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M. Sc. II Semester  
Subject Mathematics

April/May  
Nov-Dec 2016-17

Paper IV

Marks- (85, 15)

**NUMERICAL METHODS**

**Unit- I**

Solution of Algebraic Transcendental & Polynomial equations: Bisection method, Iteration method on first-degree equation: Secant method, Regula-Falsi method, Newton-Raphson method, rate of convergence of Newton-Raphson method & Secant method.

**Unit- II**

System of linear algebraic equations: Gauss Elimination method, Gauss- Jordan Elimination method, Cholesky method, Iteration methods: Jacobi Iteration method, Gauss-Seidel method.

**Unit- III**

Interpolation & approximation finite difference operators, Newton's forward and backward interpolation, Central difference interpolation, Lagrange's interpolation, Newton Dividend Difference interpolation, Hermite interpolation, Spline interpolation.

**Unit- IV**

Differentiation and integration: Numerical differentiation, Numerical integration, Newton-cotes formula, Trapezoidal rule, Simpson's one-third rule, Gauss-Legendre integration method, Lobatto integration method, Rsadau integration method.

**Unit- V**

Ordinary differential equations- Euler method, Backward Euler method, Midpoint method, Taylor Series method, Runge-Kutta methods, Predictor-Corrector methods.

**Text Books:**

1. Numerical method for scientific & Engineering Computation by M.K. Jain & R. K. Lyenger & R.K. Jain-Wiley Eastern Ltd.
2. Numerical Method by S.S. Sastry.

**Reference Books:**

1. Numerical Methods by V. RajaRaman, PHI.

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Govt. K.R.G. P.G. (Auto) College, Gwalior

M. Sc. III Semester

Subject Mathematics

Nov-Dec 2015 / 2016

Paper I

Marks- (85, 15)

**FUNCTIONAL ANALYSIS**

**Unit- I**

Nor med linear spaces, Banach spaces and examples, quotient space of nor med linear spaces and its completeness, convex sets and convex functional, lower semi-continuous and upper semi-continuous functions.

**Unit- II**

Equivalent norms, Riesz lemma, basic properties of finite dimensional nor med linear spaces and compactness. Nor med linear spaces of bounded linear transformations dual spaces with examples.

**Unit- III**

Uniform boundedness theorem and some of its consequences open mapping and closed graph theorems Hahn-Banach theorem for real linear spaces and complex linear spaces.

**Unit- IV**

Reflective spaces, Reflexivity of Hilbert spaces, Inner product spaces, Hilbert spaces. Orthonormal sets, Bessel's inequality, Complete orthonormal sets and Parseval's identity, Structure of Hilbert Spaces, Projection theorem.

**Unit-V**

Riesz representation theorem, Adjoint of an operator on a Hilbert space. Self-adjoint operators, Positive Projection, normal and unitary operators, Introduction to Sobolev spaces. Fundamental theorem of variational calculus, bilinear forms.

**Text Books:**

1. Functional Analysis with Applications by A.H. Siddique, Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Introductory Functional analysis with Applications by Kreyszig John Wiley and Sons, New York.

**Reference Books:**

1. Real Analysis by H.L. Royden Macmillan Publishing Co. New York, 4<sup>th</sup> Edition, 1993.
2. Functional Analysis by B.V. Limaye Wiley Eastern Ltd.

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*Amran* *(N)* *28/6/2016* *(N)* *28.6.16*  
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INTEGRAL EQUATIONS AND BOUNDARY VALUE PROBLEMS

**Unit- I**

Definitions of integral equations and their classification, solution of integral equation, Fredholm integral equations of second kind with separable kernels, solutions of Fredholm integral equation with separable kernel method of successive approximations.

**Unit- II**

Method of successive substitutions, iterative scheme for Fredholm integral equations of the second kind, resolvent kernel and its results, application of iterative scheme to Volterra integral equations of the second kind.

**Unit- III**

Conversion of initial value problem to Volterra integral equation and conversion of boundary value problem to Fredholm integral equation. Conversion of Fredholm integral equation to boundary value problems and conversion of Volterra integral equation to initial value problem.

**Unit- IV**

Orthonormal system of functions symmetric kernels, fundamental properties of Eigen values and Eigen functions. Green's function for symmetric kernels, Hilbert Schmidt theory and solutions of Fredholm integral equations with symmetric kernels.

**Unit-V**

Definition of a boundary value problem for an ordinary differential equation of the second order Dirac delta function, Green's function, Green's function approach to reduce boundary value problems of a differential equation with homogeneous boundary conditions to integral equations.

**Text Books:**

1. Linear Integral Equation Theory and Techniques by R.P. Kanwal Academic Press, New York, 1971.
2. Linear Integral Equation (translated from Russian) by S.G. Mikhlin, Hindustan book Agency, 1960.

**Reference Books:**

1. Boundary value problems of Mathematical Physics by L. Stakgold, Vol. I, II, Mac Miillan, 1969.

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**OPERATIONS RESEARCH**

**Unit- I**

Introduction, Nature and Meaning of O.R. Modeling in operations Research. Features of operation research, scope of operations research Linear Programming Problem: formulation of L.P.P. solution of L.P.P. Graphical Method, Simplex Methods in Duality, Integer Programming.

**Unit- II**

Assignment problems: Mathematical formulation, reduction theorem, unbalanced assignment problem. Transportation problem formulation basic feasible solution North-West-Corner method. Least cost method, Vogel's Approximation method, Optimum solution: MODI method.

**Unit- III**

Job sequencing: Processing in jobs through 2 machines, Processing in jobs through 2 machines, Processing 2 jobs through 2 machine. Replacement problems: Replacement policy for items whose maintenance cost increase with time and money value is constant. Money value changes with constant rate.

**Unit- IV**

Project management: Introduction, network diagram representation, time estimates and critical path with saddle point, rectangular game without saddle point, Principle of dominance, Graphical method.

**Unit- V**

Queuing Theory: Introduction, queuing system, Transient and steady traffic inlets, Distribution of arrival distribution of departure. M/M/L viz. FCFS model nonlinear programming: Kuhn-Fueker conditions.

**Text Books:**

1. Linear Programming by G. Hadley, Narosa Publishing House, 1995.
2. Operations Research by R.K. Gupta.

**Reference Books:**

1. Introduction to Operations Research (sixth edition) by F.S. Hillier and G.J. Lieberman Mc Graw Hill International Edition, Industrial Engineering Series 1995.
2. Operations Research by S.D. Sharma.

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Govt. K.R.G. P.G. (Auto) College, Gwalior

M. Sc. III Semester

Subject Mathematics

Nov-Dec 2015 / 2016

Paper IV

Marks- (85, 15)

ADVANCED NUMERICAL METHODS

**Unit- I**

Introduction difference calculus, difference operator, linear difference equations, first order equations general results for linear equations. Equations with constant coefficients equations with variable coefficients.

**Unit- II**

Classification of partial differential equations, Dirichlet's problem, Cauchy's problem. Finite difference approximations to partial derivatives, Elliptic equation, Numerical solutions of Laplace and Poisson equations, Solution to elliptic equations by relaxation method, solution by Laplace equation by Alternating Direction Implicit (ADI) method.

**Unit- III**

Parabolic equations, Numerical solution of one dimensional diffusion & heat equations. Schmidt method, Crank-Nicholson method, Iterative method-Dafort and Frakel method.

**Unit- IV**

Hyperbolic equations, the one dimensional wave equation, Numerical solutions of one-dimensional wave equation, Numerical solution of one dimensional wave equation by difference schemes, central-difference schemes, ~~central-difference schemes~~, D'Alembert solution.

**Unit-V**

Variational finite element method with application to one-dimensional problem, solution of time dependent problems in one dimension and two dimension & steady state problem using Ritz's method.

Text Books:

1. Difference Equation- An Introduction with Application by Walter G. Kelley and Allen C. Peterson, Academic Press Inc., Harcourt Brace Joravovich Publishers, 1991.
2. Numerical solutions of Differential Equations by M.K. Jain, New Age International (P) Limited, Publishers.

Reference Books:

1. Applied Numerical Analysis by Gerald & Wheatley, Pearson Education.

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**PARTIAL DIFFERENTIAL EQUATIONS**

**Unit-I**

Introduction, Classification of second order Partial Differential Equations (PDE), Canonical Forms, Boundary Value Problems (BVPS), Properties of Harmonic Functions, Separation of variables

**Unit- II**

Elliptic Differential Equations, Laplace Equations, Poisson Equations, Dirichlet Problem for a Rectangle. The Neumann Problem for a Rectangle, Interior Dirichlet Problem for a Circle, Exterior Dirichlet Problem for a Circle, Interior Neumann problem for a circle. Solution of Laplace Equation in Cylindrical Coordinates, solution of Laplace Equation in Spherical Coordinates.

**Unit-III**

Parabolic Differential Equations Diffusion Equations Heat Equations Occurrence of Diffusion Equation, Boundary Conditions, Elementary Solutions of the Diffusion Equation, Dirac Delta Function, Separation of Variables Method Solution of Diffusion Equation in Cylindrical Coordinates, Solution of Diffusion Equation in Spherical Coordinates.

**Unit- IV**

Hyperbolic Differential Equations, Wave Equations, Occurrence of the Wave Equation, Solution of one Dimensional Wave Equation by Canonical Reduction, the initial value problems: D' Alembert Solution, Vibrating String Variables Separable Solution, Forced Vibrations- Solution of Non homogenous Equations.

**Unit-V**

Duhamel's Principle, Green's Function, Green's Function For Laplace Equation, The method of Images, Green's Function for the Wave Equation-Helmholtz Theorem, Green's Function for the Diffusion Equation.

**Books Recommended:**

- 1. Introduction to Partial Differential Equations by K. Sankara Rao, PHI.

**Reference Books:**

- 1. Elements of Partial Differential Functions by I.N. Sneddon Mc Graw Hill

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April-May  
~~Nov-Dec 2016~~ / 2016-2017

M. Sc. IV Semester

Subject Mathematics

Paper II

Marks- (85, 15)

**ADVANCED GRAPH THEORY**

**Unit- I**

Revision of graph theoretic preliminaries, Operations on graphs, Graph Isomorphism disconnected graph and their Components. Traveling salesman problem, round table problem, Konisberg Bridge problem, Eulerian and Hamiltonian Paths and circuits.

**Unit- II**

Properties of trees, Distance, centre, radius, diameter eccentricity and related theorems, Graph as a metric space, Rooted and binary trees, Labeled graph and trees spanning tree, weighted spanning tree, Shortest path, Fundamental circuits. Rank and nullity, cut sets and cut vertices, Fundamental cut sets.

**Unit- III**

Connectivity and separability in graphs, Abstract graphs, geometric graphs, planar graphs, Kurtowski two graphs, Embedding and regions of a planar graphs, Detection of Planarity, Geometric dual and combinational dual.

**Unit- IV**

Coloring and covering of graphs, Chromatic Polynomial, chromatic partitioning, Dimmer problem, Domminating sets, Independent sets, Four colour conjecture.

**Unit- V**

Digraph and types of digraphs, Digraph and binary relation, Equivalence relation in a graph, Directed path, walk, circuit, and connectedness. Eulerian digraph, arborescence matrices A, B and C of digraph, Adjacency matrix of a digraph, Algorithms, Kruskal algorithm, Prism algorithm, Dihkstra algorithm.

**Text Book:**

1. Graph Theory with Applications to Engineering and Computer Science by Narsingh. Deo.

**Reference Book:**

1. Graph Theory by Harary.

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**DISCRETE MATHEMATICAL STRUCTURES**

**Unit- I**

Relation, Equivalence relation, Partitioning, Fundamental theorem on equivalence relation, ordered sets, First and last elements, maximal and minimal elements, upper and lower bounds, similar sets, Totally ordered sets, well ordered sets, Axioms of choice, Zorn's lemma, Well ordering theorem (statements only), Inclusion exclusion principle & Pigeon Hole principle.

**Unit- II**

Mathematical logic: Propositions and logical operators, Contradictions and Tautologies, Equivalence & Implication, Duality NAND and NOR connections, Functionally complete sets, Two-state devices and statements logic, Normal forms, Predicate calculus, Free and bound variables.

**Unit- III**

Lattice-Definition & examples, Distributive lattice, modular lattice, Bounded lattice, complemented lattice, Boolean lattice, Sublattice.

**Unit- IV**

Boolean algebra-Definition & examples, Basic Boolean algebra laws Principle of duality, Applications of Boolean algebra, Boolean functions, Disjunctive & Conjunctive normal forms, Switching circuits, Minimization of switches.

**Unit- V**

Mathematical Induction, Recursion, Recursion and iteration, closed form expression, sequence of integers, Recurrence relation, linear recurrence relation, and Homogeneous recurrence, Recurrence relations obtained from solutions, Solving linear homogenous recurrence relation, solving linear non-homogeneous recurrence relations, Generating functions, solution of recurrence relation using generating functions.

**Text Books:**

1. Discrete Mathematics by N.Ch. S.N. Iyengar, V.M. Chandra Sekharan, K.A. Venkatesh, P.S. Arunachalam- Vikas Publishing House Pvt. Ltd.
2. Set Theory-Schaum outline series.

**Reference Books:**

1. Discrete Mathematics and its applications by Keneth H. Rosen Tata Mc Graw Hill Pub, Ltd.
2. Discrete Mathematics for Computer Scientists by J.K. Truss, Pearson Education Asia Ltd.
3. Discrete Mathematical Structures with Applications by J.P. Tremblay, R. Manohar DataMc Graw Hill Pub. Company Ltd.

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April-May  
2016-2017

M. Sc. IV Semester  
Subject Mathematics

Paper IV

Math412

Special Functions

Marks- (85, 15)

Unit- I

Gamma and Beta Functions

Gamma Functions, A series for  $\Gamma'(z)/\Gamma(z)$ , Difference equation  $F(z+1) = zF(z)$ , Euler's integral for  $\Gamma(z)$ , Beta function, value of  $\Gamma(z)\Gamma(4-z)$ , Factorial Function, Legendre's duplication formula, Gauss multiplication theorem, The behavior of  $\log \Gamma(z)$  for large  $|z|$ .

Unit- II

Hypergeometric and Generalized Hypergeometric functions:

Gauss Hypergeometric Function  ${}_2F_1$  and its convergence a simple integral form evaluation of  ${}_2F_1(a, b; c; 1)$  Contiguous function relations, Hyper geometric differential evaluation Elementary series manipulations, simple transformation, generalized equation elementary series manipulations, simple transformation, Generalized hypergeometric function  ${}_pF_q$  and its convergence, Whipple's theorem, Dixon's theorem.

Unit- III

Bessel function and Legendre polynomials

Definition of  $J_n(z)$ , Bessel's differential equation, Generating function, Recurrence relations, Generating function for Legendre polynomials, Rodrigues formula, Bateman's relations. Generating function, Additional functions, Hyper geometric forms of  $P_n(x)$ , special properties of  $P_n$ , Some more functions, Laplace's first integral form, orthogonality.

Unit- IV

Hermite and Laguerre polynomials

Definition of Hermite and Laguerre polynomials, Pure recurrence relations, Differential recurrence relations, Rodrigue's formula, Other generating functions, Orthogonality for Laguerre and Hermite polynomials.

Unit- V

Mascrobert's E-function and Meijer's G- Function

Definition of Mascrobert's E-function and its expansion in series of  ${}_pF_q$  simple integrals involving E-function Meijer's G-function, Definition and Simple Properties, Simple multiplications theorems Differential equation for G-function

Books Recommended:

1. Rainville, E.D; Special Functions, The Macmillan co. New York 1971.
2. Mathai and Saxena: Generalized Hypergeometric function with Application in statistics and physical sciences, springer verlag, Heidelberg and New York, Lecture Notes no 348, 1973
3. Saran, N, Sharma S.D. and Trivedi,- Special Functions with application, Pragati prakashan, 1986.

Reference Books:

1. Lebedev, N.N. Special Functions and their Applications, Prentice Hall, Englewood Chiffs, New jersey, USA 1995.
2. Whittaker, E.T. and Watson, G.N. course of Mc Graw Hill.

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Math 410

ADVANCED MATHEMATICAL STATISTICS

Unit-I

Definitions of central tendencies, Measure of dispersions with variance in detail. Method of least square for curve fitting, correlation & regression.

Unit-II

Theory of probability & distributions: various definitions, additive & multiplicative law, Bayes' theorem, Continuous variable, Mathematical expectation, Binomial, Poisson, Normal distribution, Rectangular distribution, Exponential distribution, Moment generation function, marginal & conditional probability distributions & conditional expectation.

Unit-III

Theory of estimators: Unbiasedness, consistency, efficiency, sufficiency, maximum likelihood estimators, Cramer-Rao inequality and its applications confidence intervals with respect to normal distributions.

Unit-IV

Exact sampling distributions & tests-  $\chi^2$ , t, F, Z distributions & tests. Non-parametric tests: Sign test, Wilcoxon's signed rank sumtest, Median test, Mann-Whitney, U-test and run test for randomness.

Unit-V

Analysis of variance: one way & two-way classifications. Basic principles of design: Replication, randomization, local control, lay out and analysis of completely randomized, randomized block & latin square design; missing plot techniques in randomized block & latin square design.

Text Books:

1. Mathematical Statistics by C.E. Weatherburn.
2. Fundamentals of Mathematical Statistics by S C Gupta & V K Kapoor. S. Chand & Sons, New Delhi.
3. Fundamentals of Applied Statistics by S C Gupta & V K Kapoor, S Chand & Sons, New Delhi.

Reference Books:

1. An outline of Statistical Theory by Goon, Gupta & Dasgupta.
2. Fundamentals of Statistics by Goon, Gupta Dasgupta.

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Anjana

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