ABOUT UNIVERSITY

Dr. C.V. Raman University was established on 3 November, 2006, in the district of Bilaspur, Chhattisgarh by the "All India Society for Electronics and Computer Technology" (AISECT), the Sponsoring Body. The University was named after the first Nobel Laureate of the country in the field of science – Dr. C.V. Raman, an Indian physicist efforts influenced in the growth of science in our country. The University's principle goal is to evolve a new cadre of highly skilled technical professionals with deep academic insights and a strong sense of Indian 'Values and ethics', commemorating our forefathers who helped shape this nation.

The Sponsoring Body of the University-All India Society for Electronics and Computer Technology (AISECT) is an ISO 9001:2008 certified organization, established in 1985 and is today's one of The India's most reputed and trusted Education Groups which houses private Universities, Engineering Colleges, Professional Institutions & Education Centres across the country. Till date, AISECT has transformed the lives of over 19 lakh students and has uplifted the lives of millions of people in the community. AISECT has been lauded for its exceptional work and has won awards from the World Bank, NASSCOM, TiE, Government of India, Government of Madhya Pradesh and several others on account of its commitment to high quality education over the last 28 years. AISECT is also a partner institution with Gol, GoMP and GoCG in their Common Service Centre Program and several other projects of state and national concern.

MAIN OBJECTIVES

- Provide quality higher education and make provisions for research
- Create higher levels of intellectual abilities among our students
- Establish state-of-the-art facilities for education, training and examination, including online training
- Carry out teaching, research and offer comprehensive learning for a bright professional career
- Create centers of excellence for R&D to promote an environment of innovation and research
- Provide consultancy to public organizations and the Industry
- Award and maintain the standard of degrees, diplomas, certificates and other academic distinctions in accordance with the norms laid down by UGC, AICTE, BCI, MCI and other regulatory bodies.

RECOGNITIONS

- The University is recognized under Section 2(f) of the UGC Act.
- Joint Committee Approval of DEB(UGC/AICTE/DEB)
- Other recognitions include AICTE, NCTE, BCI and DEB
- It is the first University in the state of Chhattisgarh to be awarded an ISO: 9001-2008 Certification.
- Membership of the Association of Indian Universities (AIU)
- NACC B+

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THE FACULTIES OF STUDIES

The University has wide range of faculties which offers the traditional as well as the new era job oriented courses. The main emphasis is on providing a wide choice of courses at different levels. The following faculties currently are in operation in the University:

- Faculty of Arts
- Faculty of Commerce
- Faculty of Management
- Faculty of Science
- Faculty of Engineering
- Faculty of Information Technology
- Faculty of Education
- Faculty of Law

ABOUT INSTITUTE OF OPEN AND DISTANCE EDUCATION (IODE), CVRU

Education determines the quality of our life to a great measure, especially professional life. However, for many, in some circumstances, the path to education is ridden with many obstacles, including location, geographical inflexibility and lack of time. Fortunately, distance education is changing that scenario by providing an effective alternative platform to learn new skills and acquire a degree, such as distance education MBA, without having to attend traditional classes.

We, a UGC/DEB approved distance university (1 may 2009), offer various undergraduate and post-graduate degrees, along with a number of diplomas, which have benefitted many distance learners.

Our distance learning programmes are the shining light that many have been looking for; they unite conventional teaching approaches, including course materials in the form of books, and modern teaching methodologies, which include online access to the course. Our unique approach has made us the centre of distance education in Chhattisgarh, helping scores of professionals to obtain a degree and fly high in their careers.

With our distance learning programmes, we are bringing people into the fold of skilled workforce, which has changed the life of many.

What makes us a distinguished Chhattisgarh distance education university?

- Reaching various far-flung regions of the state through information technology
- Providing professional education, need- and knowledge-based
- Setting new national standards in distance education

IMPORTANT ACHIEVEMENTS

- AN ISO 9001: 2008 Certified University

- NIRF Ranking Under Top 200 University

- World Education Award

- Largest Network for Learning Support System.

- Declaration of Term end result Time to Time.

- Best in Skill Development Award 2015

- Best University in Open Distance and online Award 2017

ACADEMIC PROGRAMMES OFFERED BY THE UNIVERSITY IN OPEN AND DISTANCE LEARNING MODE

The University offers through the Institute of Open and Distance Education (IODE) both short term and long term programmes leading to Certificates, Diploma and Degrees, which are conventional as well as innovative. Most of these programmes have been developed after an initial survey of the demand for such Programmes in the job market. They are launched with a view to fulfil the learner's need for skill and employability.

- Certification,
- Improvement of skills,
- Acquisition of professional qualifications,
- Continuing education and professional development at work place,
- Self-enrichment,
- Diversification and updation of knowledge, and
- Empowerment.

PROMINENT FEATURES OF THE OPEN AND DISTANCE EDUCATION AT CVRU

The open and distance education at the Dr. C. V. Raman University has certain unique features such as

- Individual study - flexible in terms of place, pace and duration of study.
- Use of latest information and communication technologies.
- Modular approach to programmes.
- Cost-effective programmes.
- Socially and academically relevant programmes based on students need
- Convergence of open and conventional education systems.
- Take higher-education to the unreached sections of the society through the use of information technology.
- Provide need and knowledge-based professional education.
- Set the national standards for Distance Education.

PROGRAMME DELIVERY MODE

The methodology of instruction in the distance learning mode in the university is different from that of the conventional regular programs. The system adopted for this more learner oriented and the learner is an active participant in the pedagogical process. Most of the instructions are imparted through distance education methodology and face to face mode as per requirement. The programme delivery methodology used in the distance learning mode follows a multimedia approach for instructions, which compromises:

- **Self Instructional Written Material:** The printed study material (written in self instructional style) for both theory and practical components of the programs is supplied to the learners in batches for every course.

- **Audio-Visual Material Aids:** The learning package contains audio and video CDs which have been produced/adopted by the University for Better Clarification and enhancement for understanding of the course material given to the learners. A video programme is normally of 25-30 minutes duration. The video cassettes are screened at the leaner support centre during specific sessions which are duly notified for the benefit of the learners.

- **Counseling Sessions:** Normally counseling sessions are held as per schedule drawn by the IODE DR. C. V. RAMAN UNIVERSITY. These are mostly held outside the regular working hours of the learner support centre.

- **Teleconferences:** Live teleconferencing sessions are conducted via Internet/ satellite through interactive Video Conferencing facility (available at some places) from the University studios, the schedule of which is made available at the learner support centre.

- **Industrial Training/Practical/Project work:** Some programmes have industrial training/practical/ project component also. Practical are held at designated institutions for which schedule is provided by the learner support centre. Attendance at practical is compulsory. For Project Work, comprehensive project guide, in the form of booklet, is provided to the student along with the study material.

- The printed study materials will be dispatched periodically to the enrolled students for each paper of study. These materials will be as guide for the students for effective learning. The assignment for internal assessment shall also be dispatched along with the study material. Online modules are also available for some courses. These are in progress and as and when available, these will be available on the website of the students for registered candidates.

- The counseling sessions will be of 30 days duration for a course in a year. The actual schedule and place of contact program shall be announced and communicated to students in – time.

EVALUTION SYSTEM

The system of evaluation in open and distance learning system has a multi-tier system of evaluation.

1. Self-assessment exercise within each unit of study.
2. Continuous evaluation mainly through assignments which are tutor-marked practical assignments and seminar/workshop/extended.
3. The term-end examinations.
4. Project work.

The evaluation of learners depends upon various instructional activities undertaken by them. A learner has to write assignment responses compulsorily before taking term-end examination from time to time to complete an academic programme. A learner has to submit TMA responses to the learner support centre established by IODE Dr. C. V. Raman University. A learner should keep duplicate copies of assignments responses of TMA that may be required to be produced at Student Evaluation Division on demand. Term-end examination will be conducted at various examination centre approved by institute of open and distance education Dr. C. V. Raman university spread all over the Chhattisgarh. The weightage for Term End Examination will be 70% and weightage for Internal Assessment will be 30 % for this programme.

TERM-END EXAMINATION AND PAYMENT OF EXAMINATION FEE

The University conducts Term-end Examination in semester system and held in the month of Nov/Dec and May/June every year. Students will be permitted to appear in term-end examination subject to the conditions that:

1. Registration for the courses, in which they appeared is valid,
2. Minimum Time to pursue these courses is elapsed.
3. Submission of required number of assignment in respective courses by the due date.

Students can also submit on-line examination form as per guidelines through website at www.cvru.ac.in. Examination fee is required to be paid online payment gateway as per the fee table. Please do all correspondence regarding the course admission and other detail at the following address:

<div align="center">

The Director

Institute of Open and Distance Education (IODE)

Dr. C. V. Raman University

Kargi Road, Kota, Bilaspur, Chhattisgarh

Phone: 07753253851, 8827920016, 8827920019

Email: cvrussd@gmail.com

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LEARNER SUPPORT DESK:

Phone: 07753253872, 07753-253873, 8359050061

Email: cvrussd@gmail.com

PROGRAMME GUIDE

DISTANCE EDUCATION PROGRAMMES

MASTER OF SCIENCE (M. Sc.) – MATHS

- Scheme of Examination
- Detailed Syllabus & Reference Book
- Counseling and Study Structure
- Study Modules & Books Information
- Date Schedule & Instructions for Submitting Assignments

INSTITUTE OF OPEN AND DISTANCE EDUCATION (IODE)
DR. C.V.RAMAN UNIVERSITY

KARGI ROAD, KOTA, BILASPUR, CHATTISGARH
PHONE : 07753-253851, 8827920016, 8827920019 FAX : 07753-253728
E-mail: cvrussd@gmail.com, Website: www.cvru.ac.in

MASTER OF SCIENCE (M.Sc.) – MATHAMATICS

Duration:24 Months (2 Years)   **Eligibility : Graduation with Maths Subject**

SCHEME OF EXAMINATION

Course Code	Name of the Course	Credit	Total Marks	Theory		Practical Marks		Assignments	
				Max	Min	Max	Min	Max	Min
FIRST SEMESTER									
1MSCM1	Advanced Abstract Algebra-I	4	100	70	25	-	-	30	11
1MSCM2	Real Analysis-I	4	100	70	25	-	-	30	11
1MSCM3	Topology-I	4	100	70	25	-	-	30	11
1MSCM4	Complex Analysis-I	4	100	70	25	-	-	30	11
	Total	**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**
SECOND SEMESTER									
2MSCM1	Advanced Abstract Algebra-II	4	100	70	25	-	-	30	11
2MSCM2	Real Analysis-II	4	100	70	25	-	-	30	11
2MSCM3	Topology-II	4	100	70	25	-	-	30	11
2MSCM4	Complex Analysis-II	4	100	70	25	-	-	30	11
Total		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**
THIRD SEMESTER									
3MSCM1	Functional Analysis-I	4	100	70	25	-	-	30	11
3MSCM2	Integral Transform-I	4	100	70	25	-	-	30	11
3MSCM3	Special Functions-I	4	100	70	25	-	-	30	11
3MSCM4	Elective-I(Advance Discrete Mathematics)	4	100	70	25	-	-	30	11
Total		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**
FOURTH SEMESTER									
4MSCM1	Functional Analysis-II	4	100	70	25	-	-	30	11
4MSCM2	Integral Transform-II	4	100	70	25	-	-	30	11
4MSCM3	Special Functions-II	4	100	70	25	-	-	30	11
4MSCM4	Elective-II(Operation Research)	4	100	70	25	-	-	30	11
Total		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**

ELECTIVE PAPERS IIIRD & IVTH SEMESTER

Optional Papers for 3MSCM4 / 4MSCM4	
A	Advance Differential Equation
B	Advance Discrete Mathematics
C	Operations Research
D	Graph Theory
E	Mathematics Modeling
F	Fundamental of Computers
G	Advance Numerical Analysis
H	Partial Differential Equations

Evaluation Scheme

1.   36% in each theory, practical, project, dissertation & internal assessment but the total Aggregate for passing is 40%.

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- First Semester

PROGRAMME:- M.SC.MATHAMATICS　　　　　　THEO. MAX. M: 70 MIN. M: 25
COURSE CODE:-1MSCM1,CREDIT-4　　　　　　ASSIG. MAX.M: 30 MIN. M: 11
COURSE:- ADVANCED ABSTRACT ALGEBRA-I

UNIT-I

Normal and subnormal series of group, composition series of group, Jordan- holder theorem.

UNIT-II

Solvable and Nilpotent groups,

UNIT-III

Field & subfield definition & Examples, Extension fields, Algebraic extensions , Separable and Irseparable extensions Normal extension, Perfect fields

UNIT-IV

Class equation of finite group, Cauchy's theorem for finite groups, Sylow Theorem, Wilson's Theorem, Lagrange's Theorem.

UNIT-V

Polynomial Ring R[x] over a Ring R in an indeterminate X, Primitive polynomial .The ring of Gaussian integers as an Euclidean domain, Fermat's Theorem, Unique Factorization domain.

TEXT AND REFERENCE BOOK

- J.N. Sharma and A.R. Vasishtha, Abstract Algebra, Krishna Prakashan Media (P) Ltd. Meerut, Delhi.
- Shanti Narayan, Modern Abstract Algebra, S.Chand & Co. New Delhi.
- R.S.Verma, Algebra, Pathshala Pvt. Ltd. Allahabad.
- S.K. Jain, P.B. Bhattacharya and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press (1997)
- H.K.Pathak, Advanced Abstract Algebra, Shiksha Sahitya Prakashan,Meerut.

Dr. C.V. RAMAN UNIVERSITY

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- First Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25
COURSE CODE:-1MSCM2,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11
COURSE:- REAL ANALYSIS-I

UNIT-I

Sequences & subsequences, Convergent sequence, divergent sequence and some theorems, Real Valued function & Theorems, Cesaros's Theorem, Nested Interval theorem, Limit superior and Limit Inferior.

UNIT-II

Series of Non-negative terms, comparison test, cauchy's condensation test, comparison of ratios, Logarithmic test, D'morgan and bertrand's test.

UNIT-III

General Principal of convergence, pringsheims Method, Merten's Theorem, Abel's Theorem, Euler's constant Theorem.

UNIT-IV

Neighbourhoods, open set and closed set & properties, Bolzano-weierstranss Theorem, Baire category theorem for R, covering Theorem.

UNIT-V

Limit and continuity Theorems on continuity, Bolzano's theorem on continuity, continuity of inverse function, Geometrical meaning of a derivative, chain Rule of Derivative, Darboux Theorem and cauchy's mean value Theorems.

TEXT AND REFERENCE BOOK

- Valter Royden, Principle of Mathematical Analysis, Tata McGraw Hill.
- P.K. Jain & N.K.Ahamed, Metric Spaces, Narosa Publishing House New Delhi 1996.
- P.K.Jain & S.K. Kaushik, An Introduction to real analysis, S.Chand & Co. New Delhi.
- H.K. Pathak, Real Analysis, Shiksha Sahitya Prakashan, Meerut.
- J.N.Sharam & A.R. Vasishtha, Real Analysis, Krishna Publication, Pvt. Ltd.

Dr. C.V. RAMAN UNIVERSITY

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SEMESTER- First Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25
COURSE CODE:-1MSCM3,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11
COURSE:- TOPOLOGY-I

UNIT-I

Definition and examples of topological space, Opensets, Closed sets , Closure , Dense subsets.

UNIT-II

Neighborhoods , Interiors ,exteriors and boundry .Accumulation point and derived sets ,bases and sub-bases,subspaces and relative topology .

UNIT-III

Continuous Maps, Continuous Maps into R, open and closed maps, Homeomorphism, Finite product spaces, projection maps.

UNIT-IV

Connected space and disconnected spaces, separated sets, component, locally connected space, Path connectedness, separation axioms : T0, T1 and T2 Spaces.

UNIT-V

Introduction of compactness, compact subspace, Finite intersection property, Bolzano-weierstrass property, countable, sequential and local compactness.

TEXT AND REFERENCE BOOK

- G.F. Simmons, Introduction to topology and modern analysis, Tata McGraw Hills.
- K.D.Joshi, Introduction to General Topology, Wiley Eastern.
- J.N. Sharma, Topology, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- J.M. Munkers, Topology, Publication Tata McGraw Hill.
- H.K.Pathak, Topology, Shisksha Sahitya Prakashan, Meerut.

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- First Semester

PROGRAMME:- M.SC.MATHAMATICS   **THEO. MAX. M: 70 MIN. M: 25**
COURSE CODE:-1MSCM4,CREDIT-4   **ASSIG. MAX.M: 30 MIN. M: 11**
COURSE:- COMPLEX ANALYSIS-I

UNIT-I

Complex Number, Analytic Functions, Cauchy – Riemann Equations, Harmonic Functions, Conjugate functions.

UNIT-II

Conformal mappings, Bi-linear transformations, Geometrical interpretations of the transformations $w = z+\alpha$, $w = \beta z$, $w = \gamma z$. Bi-linear transformation of a circle.

UNIT-III

Complex integration, complex integrals as sum of two real line integrals, Cauchy's Theorem, Extension of cauchy's Theorem to multi – connected region Cauchy.

UNIT-IV

Cauchy integral formula, Extension of cauchy's integral formula to multiconnected regions, Liouville's Theorem, Morea's theorem.

UNIT-V

Taylor's Theorem, Laurent's Theorem with examples.

TEXT AND REFERENCE BOOK

- V.S.Tyagi, Functions of a complex variable, Kedarnath Ramanath Delhi.
- S. Ponnusony, Foundation of Complex analysis, Narosa Publishing House.
- John & Mathews Russell Wottowell, Complex analysis for Mathematics & Engineering.
- H.K. Pathak, Complex Analysis, Shiksha Sahitya Prakashsn Meerut.
- J.N. Sharma, Complex Functions, Krishna Prakashan Media (P) Ltd. Meerut Delhi.

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- Second Semester

PROGRAMME:- M.SC.MATHAMATICS   **THEO. MAX. M: 70 MIN. M: 25**
COURSE CODE:-2MSCM1,CREDIT-4   **ASSIG. MAX.M: 30 MIN. M: 11**
COURSE:- ADVANCED ABSTRACT ALGEBRA-II

UNIT-I

Introduction to modules- Examples, sub modules, quotient modules.Module homomorphism, isomorphism.

UNIT-II

Finite generate modules, Fundamental structure theorem for finitely generated moduls over a principal ideal domain its application of finitely generated abelian group. cyclic modules.

UNIT-III

Simple modues, semisimple modules, free modules ,Schurs lemma. Neotherian&artinian modules and ring

UNIT-IV

Schroeder- Bernstion Theorem, Hillebert basic Theorem, Wedderburn - Artin Theorem,

UNIT-V

Uniform modules, primary modules, Noether - Laskar Theorem. Fundamental structure theorem of module over a principle ideal domain and its application to finitely generated abelian groups.

TEXT AND REFERENCE BOOK

- J.N. Sharma and A.R. Vasishtha, Abstract Algebra, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- Shanti Narayan, Modern Abstract Algebra, S.Chand & Co. New Delhi.
- R.S.Verma, Algebra, Pathshala Pvt. Ltd. Allahabad.
- S.K. Jain, P.B. Bhattacharya and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press (1997)
- H.K Pathak, Advanced Abstract Algebra, Shiksha Sahitya Prakashan Meerut.

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- Second Semester

PROGRAMME:- M.SC.MATHAMATICS	**THEO. MAX. M: 70 MIN. M: 25**
COURSE CODE:-2MSCM2,CREDIT-4	**ASSIG. MAX.M: 30 MIN. M: 11**
COURSE:- REAL ANALYSIS-II	

UNIT-I

Defination of Riemann-Stieltses Integral & theorems, The Rs-Integral as limit of sums, Some classes of Rs-Integrable function, Algebra of Rs-Integrable function, The Interval of integration, The Rs-Integrability of composite function.

UNIT-II

Relation between R- Integral & Rs-Integral, Integration of vector valued function, some more Theorems on integration.

UNIT-III

Continuity of function of two variables, Partial Derivatives, Differentiability of two variables, Differentiability of composite function.

UNIT-IV

Differentiation, Differentiation of vector-valued function, Differentiation in Rn, The implicit function Theorem.

UNIT-V

Definition of Jacobians', Case of function of function, Jacobian of implicit functions, Necessary and Sufficient condition for a Jacobian to Vanish Identically.

TEXT AND REFERENCE BOOK

- Valter Royden, Principle of Mathematical Analysis, Tata McGraw Hill.
- P.K. Jain & N.K.Ahamed, Metric Spaces, Narosa Publishing House New Delhi 1996.
- P.K.Jain & S.K. Kaushik, An Introduction to real analysis, S.Chand & Co. New Delhi.
- H.K. Pathak, Real Analysis, Shiksha Sahitya Prakashan Meerut.
- J.N.Sharma and A.R. Vasishtha, Real Analysis, Krishna Publication, Pvt. Ltd.

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SEMESTER- Second Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25

COURSE CODE:-2MSCM3,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11

COURSE:- TOPOLOGY-II

UNIT-I

Separation Axioms: Regular and T3 spaces, normal and T4 spaces, Urysohn's Lemma, Tietze's, Extension theorem, completely regular and Tychonoff spaces, completely normal and T5 spaces.

UNIT-II

Countablility Axioms: First and second axioms of countablility, Lindelof spaces , Separable spaces , Coutably compact spaces, Limit point compact spaces.

UNIT-III

Convergence in Topology: Sequences and subsequences, convergence in topology, sequential compactness, local compactness, one point compactification, Stone-Cechcompactification.

UNIT-IV

Metric Spaces and Metrizability: Separation and countability axioms in metric spaces, convergence in metric spaces, complete metric spaces.

UNIT-V

Product Spaces: Arbitrary product spaces, product invariance of certain separation and countability axioms, Tychonoff's Theorem, product invariance of connectedness.

TEXT AND REFERENCE BOOK

- G.F. Simmons, Introduction to topology and modern analysis, Tata McGraw Hills.
- K.D.Joshi, Introduction to General Topology, Wiley Eastern.
- J.N. Sharma, Topology, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- J.M. Munkers, Topology, Publication Tata McGraw Hill.
- H.K.Pathak, Topology, Shisksha Sahitya Prakashan, Meerut.

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- Second Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25
COURSE CODE:-2MSCM4,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11
COURSE:- COMPLEX ANALYSIS-II

UNIT-I

Fundamental theorem of integral calculus for complex functions, uniqueness theorem, The zero of an analytic function, Singularities of an analytic function.

UNIT-II

Residues, Cauchy's residue theorem, Evaluation of real definite integrals by contour integration, Integration round the unit circle.

UNIT-III

Evaluation of the integral $\int_{-\infty}^{\infty} f(x)\,dx$. Evaluation of the integrals of the form $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)}\,dx, \int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx\,dx$, m>0, where P(x),Q(x) are polynomials,deg Q(x) >deg P(xQ(x)=0 has no real roots.

UNIT-IV

Fixed points or Invariant points of a Bilinear transformation, Normal form of a Bilinear transformation, Elliptic, Hyperbolic and parabolic transformations, some special Bilinear transformations.

UNIT-V

Analytic, Holomorphic and Regular function, Polar form of Cauchy-Riemann Equations, Derivative of w = f(z) in polar form, orthogonal System, Multiple Valued function.

TEXT AND REFERENCE BOOK

- V.S.Tyagi, Functions of a complex variable, Kedarnath Ramanath Delhi.
- S. Ponnusony, Foundation of Complex analysis, Narosa Publishing House.
- John & Mathews Russell Wottowell, Complex analysis for Mathematics & Engineering.
- Dr. H.K. Pathak, Complex Analysis, Shiksha Sahitya Prakashsn, Meerut.
- J.N. Sharma, Complex Functions, Krishna Prakashan Media (P) Ltd. Meerut Delhi.

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- Third Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25
COURSE CODE:-3MSCM1,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11
COURSE:- FUNCTIONAL ANALYSIS-I

UNIT -I

Normed linear space, Banach spaces examples and theorems, Holders inequality, Minkowshki's inequality, Cauchy's inequality.

UNIT -II

Completeness of c^n , the space l_p^n , completeness of l_p^n ,the space l_p ,Riesz – Fisher theorem.

UNIT -III

Sub space and Quotient spaces of Banach space ,Narm of Bounded (continuous) linear transformation , basic properties of finite dimensional normed linear space.

UNIT -IV

Compactness , Equivalent norms ,Riesz –lemma ,Convexity theorem ,the natural imbedding of N in N**, Reflexivility.

UNIT -V

The conjugate space of l_p ,weak convergence , the conjugate of an operator , dual spaces with examples , uniform boundedness theorem.

TEXT AND REFERENCE BOOK

- V.Choudhary & Sudarshan Nanda, Functional Analysis with applications, Wiley Eastern Ltd. New Delhi.
- H.K.Pathak, Functional Analysis, Shiksha Sahitya Prakashan Meerut.
- J.N. Sharma and A.R. Vasishtha, Functional Analysis, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- P.K.Jain, O.P. Ahuja & K. Ahamad, Functional Analysis, New Age International (P) Ltd. Wiley Eastern Ltd. New Delhi, 1997.
- K.K.Jha, Functional Analysis, Students Friends 1986.

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)
SEMESTER- Third Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25

COURSE CODE:-3MSCM2,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11

COURSE:- INTEGRAL TRANSFORM-I

UNIT –I

Definition and Properties .Sufficient Conditions for the existence of Laplace Transform. Laplace Transform of some elementary functions. Laplace Transform of the derivatives. Inverse of Laplace Transform. Initial and final theorems..Learch's theorem .Heaviside's expansion theorem.Convolution theorem.

UNIT-II

Some of ordinary Differential Equations with Constant Coefficients.Solution of ordinary differential equation with variable coefficients.Solution of Simultaneous ordinary differential equation.Solution of Partial differential equations.Application to electrical equations .Application to mechanics. Application of Laplace transform to integral equations.

UNIT-III

Application of Laplace transform in initial Boundary   value problems.Heat conduction equation.Waveequation.Laplace equation Application to Beams.

UNIT-IV

Dirichlet'scondition.Fourierseries.Fourierintegralformula,Fouriertransform or complex Fourier transform. Inversion theorem for complex Fourier transform. Fourier Sine and Cosine Transform.Change of Scale Property, Shifting Property .Modulation theorem. Multiple Fourier transform. Convolution. The Convolution or faltingtheorem for Fourier transform. Parseval'sidentity for Fourier transform.

UNIT-V

Finite Fourier sine transform. Inversion formula for sine transform. Finite Fourier cosine transform. Inversion formula for cosine transform. Multiple finite Fourier transform theorems on operational properties of finite sine and cosine transform. Combined properties of finite Fourier sine and cosine transform .

TEXT AND REFERENCE BOOK

- I.N. Sneddon, The Uses & Integral Transform,
- C.J.Tranter, Integral Trnasform
- D.C.Agrawal, Advance Integral Transforms,
- Goel & Gupta, Integral Calculus,

Dr. C.V. RAMAN UNIVERSITY

Institute of Open and Distance Education (IODE)
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- Third Semester

PROGRAMME:- M.SC.MATHAMATICS   **THEO. MAX. M: 70 MIN. M: 25**
COURSE CODE:-3MSCM3,CREDIT-4   **ASSIG. MAX.M: 30 MIN. M: 11**
COURSE:- SPECIAL FUNCTION-I

UNIT – I

Special Functions, Infinite series, orthogonal Polynomials, eulerian definition WeistrassDefination, EulerianProduct $\Gamma(z)$. Evaluation of $\Gamma(1)$ and $\Gamma(\frac{1}{2})\Gamma(\frac{1}{2})$ Equivalence of Weierstrass and Euler Defination , Factorial Function Gauss' Multiplication Formula .

UNIT – II

Hypergeometric Function , Integral Represention of f(a,b ; c,z) Relation of contigulity , Hypergeometric differential equation , transformation of f(a,b ; c,z)

UNIT – III

Introduction of generalized HypergeometricFunction , Differential Equation Satisfied by pfq , saalsehutz Theorem , whipples Theorem , Dixon's Theorems

UNIT – IV

Integrals involving Generalized hypergeometric Functions, Kummers Theorems, Ramanujans Theorems.

UNIT – V

Generating Function for Jn(z) , Alternative Form of Generating Function Recurrence relation for Jn(z) , Bessel's integral , Spherical Bessel Functions , Neumann Polynomials & series .

TEXT AND REFERENCE BOOK

- P.K Jain, O.P. Ahuja & K.Ahamad, Special Function, New international (P) Ltd., Wiley

Eastern Ltd. New Delhi
- E.C. Titchmarsh, The theory of functions, Oxford University Press London.
- J.N.Sharma, Special function, Pragati Prakashan Meerut.
- H.K. Pathak, Special Function, Shiksha Sahitya Prakashan, Meerut .

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SEMESTER- Third Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25
COURSE CODE:-3MSCM4,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11
COURSE:- ADVANCE DISCRETE MATHEMATICS
          (ELECTIVE SUBJECT)

UNIT – I

Algebraic Structures : Introduction , Algebraic Systems : Examples and Genral Properties : Defination and Examples , Some Simple Algebraic Systems and Genral Properties , Homomorphism and Isomorphism congruence releation ,.

UNIT – II

Semigroup&Monoids :Defination& Examples , Homomorphism of semigroups and Monoids

UNIT – III

Lattices : Lattices as Partially ordered Sets : Defination and Examples , Principale of duality , some Properties of Lattices , Lattices as Algebraic Systems , Sublatttices , Direct Product and Homomorphism.

UNIT – IV

Some special Lattices e.g. complete , Complemented and Distributive Lattices , Boolean Algebra : definition and Examples , Subalgebra , Direct product and Homomorphism , Join irreducible , atoms and antiatoms.

UNIT – V

Trees : Trees and its properties, minimally connected graphs pendant vertices in a tree, distance and centers in a tree , rooted and binary tree Levels in a binary tree , height of a tree , Spanning tress , rank and Nullity.

TEXT AND REFERENCE BOOK

- H.K. Pathak, Advance Discrete Mathematics, Shiksha Sahitya Prakashan, Meerut.

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SEMESTER- Fourth Semester

PROGRAMME:- M.SC.MATHAMATICS   **THEO. MAX. M: 70 MIN. M: 25**

COURSE CODE:-4MSCM1,CREDIT-4   **ASSIG. MAX.M: 30 MIN. M: 11**

COURSE:- FUNCTIONAL ANALYSIS-II

UNIT -I

Open mapping theorem ,Closed graph theorem , Hahn –Banach theorem for linear spaces .

UNIT -II

Inner product spaces , Hilbert spaces , some properties of Hilbert spaces ,Schwarz inequality ,.

UNIT -III

Orthogalcomplements , projection theorem , Ortthonarmel sets , Bessel's inequality ,complete Orthonarmal set .

UNIT -IV

The conjugate space H* ,Riesz representation theorem for continuous linear functional on a Hilbert space .

UNIT -V

The Adjoint of an Oprtator , self adjoint operator ,Normal and operators.

TEXT AND REFERENCE BOOK

- V.Choudhary & Sudarshan Nanda, Functional Analysis with applications, Wiley Eastern Ltd. New Delhi.
- H.K.Pathak, Functional Analysis, Shiksha Sahitya Prakashan Meerut.
- J.N. Sharma and A.R.Vasishtha, Functional Analysis, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- P.K.Jain, O.P. Ahuja & K. Ahamad, Functional Analysis, New Age International (P) Ltd. Wiley Eastern Ltd. New Delhi, 1997.
- K.K.Jha, Functional Analysis, Students Friends 1986.

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SEMESTER- Fourth Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25

COURSE CODE:-4MSCM2,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11

COURSE:- INTEGRAL TRANSFORM-II

UNIT-I

Application of Fourier transform in initial and boundary value problems: Application of infinite Fourier transform.Choice of infinite sine or cosine transforms. Applications of finite Fourier transform. Finite Fourier transform of partial derivatives.

UNIT-II

Definition of Hankeltransform.Inversion formula for the Hankel transforms. Some important results for Bessel functions.Linearity property.Hankel transform of the Derivatives of a Function.

UNIT-III

Hankel transform of$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2}{x^2}f$. Parseval's Theorem .Definition of finite Hankel transform. Another form ofHankeltransform.Hankel transformof $\frac{df}{dx}$.

UNIT-IV

Hankel transform of$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx}$,where p is the root of the equation$J_n(ap)$=0.Applications of HankelTransform in initial and boundary value problems.

UNIT-V

Definition of Mellin transforms. The Mellin Inversion theorem.Linearity property. Some elementary properties &Mellintransform.Mellin transform of derivatives. Mellin transform of integrals. Convolution (or falting).

TEXT AND REFERENCE BOOK

- I.N. Sneddon, The Uses & Integral Transform,
- C.J.Tranter, Integral Trnasform
- D.C.Agrawal, Advance Integral Transforms,
- Goel & Gupta, Integral Calculus,

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SEMESTER- Fourth Semester

PROGRAMME:- M.SC.MATHAMATICS   THEO. MAX. M: 70 MIN. M: 25

COURSE CODE:-4MSCM3,CREDIT-4   ASSIG. MAX.M: 30 MIN. M: 11

COURSE:- SPECIAL FUNCTION-II

UNIT – I

Introduction of Hermit Polynomials solution of Hermites differential equation , Generating Function of Hermites Polynomials Rodrigues Formula for $Hn(x)$, Recurrence relations for $Hn(x)$

UNIT – II

Bateman's Generating Releation Integral Representation of Hermite Polynomial ortnagonal Properties of $Hn(x)$, Expansions of Polynomials .

UNIT – III

Introduction of Laguerre Polynomials Solution of Laguerres differentials , Equation , Generating Function of LaguerrePolynomilas , Rodrigues Formula, Recurrence Releations of Rodrigues Formula.

UNIT – IV

GenerlisedLaguerrePolynomial ,RecurrenceReleation .

UNIT – V

Introduction of Jacobi Polynomials, Generating Functions of Jacobi Functions Rodrigues Formula, Orthogonal Properties Recurrence Releation.

TEXT AND REFERENCE BOOK

- P.K Jain, O.P. Ahuja & K.Ahamad, Special Function New international (P) Ltd. Wiley Eastern Ltd. New Delhi
- E.C. Titchmarsh The theory of functions Oxford University Press London.
- J.N.Sharma, Special function, Pragati Prakashan Meerut.
- H.K. Pathak, Special Function, Shiksha Sahitya Prakashan, Meerut.

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SEMESTER- Fourth Semester

PROGRAMME:- M.SC.MATHAMATICS   **THEO. MAX. M: 70 MIN. M: 25**

COURSE CODE:-4MSCM4,CREDIT-4   **ASSIG. MAX.M: 30 MIN. M: 11**

COURSE:- OPERATION RESEARCH
          (ELECTIVE SUBJECT)

UNIT – I

Operation research and its Scope , Necessity of Operation Research in Industry , Linear Programming – Simplex Method, theory of the Simplex Method , Duality and Sensitivity Analysis

UNIT – II

Algorithms for Linear Programming- Dual Simplex Method , Parametric Linear Programming , Upper – Bound Technique , Interior Point Algorithm, Linear Goal Programming.

UNIT – III

Transportation and Assignment Problems.

UNIT – IV

Networks Analysis – Shortest Path Problem , Minimum Spanning Tree Problem , Maximum Flow Problem , Minimum cost Flow Problem , Network Simplex Method , Project Planning.

UNIT – V

Dynamic Programming-Deterministic and Probabilistc Dynamic Programming

TEXT AND REFERENCE BOOK

- P.K.Gupta & D.S.Hira, Operations Research, S.Chand & Company Ltd.
- R.Panneerselvan, Operations Research.
- P.M.Karak Linear Programming Problem of Operation Research New Central Book Agency.
- R.K. Gupta, Operations Research, Krishna Public House.
- A.P.Verma,Operetions Research, S.K.Kataria & Sons.

COUNSELING AND STUDY STRUCTURE

Sl. No.	Course Code	Title of the Course	Credit	Total Hours of Study	Counselling and Study Structure (hours)			
					Face to Face Counselling	Self study	Practical	Assignments
SEMESTER I								
1	1MSCM1	Advanced Abstract Algebra-I	4	120	16	68	-	36
2	1MSCM2	Real Analysis-I	4	120	16	68	-	36
3	1MSCM3	Topology-I	4	120	16	68	-	36
4	1MSCM4	Complex Analysis-I	4	120	16	68	-	36
SEMESTER II								
5	2MSCM1	Advanced Abstract Algebra-II	4	120	16	68	-	36
6	2MSCM2	Real Analysis-II	4	120	16	68	-	36
7	2MSCM3	Topology-II	4	120	16	68	-	36
8	2MSCM4	Complex Analysis-II	4	120	16	68	-	36
SEMESTER III								
9	3MSCM1	Functional Analysis-I	4	120	16	68	-	36
10	3MSCM2	Integral Transform-I	4	120	16	68	-	36
11	3MSCM3	Special Functions-I	4	120	16	68	-	36
12	3MSCM4	Elective-I (Advance Discrete Mathematics)	4	120	16	68	-	36
SEMESTER IV								
13	4MSCM1	Functional Analysis-II	4	120	16	68	-	36
14	4MSCM2	Integral Transform-II	4	120	16	68	-	36
15	4MSCM3	Special Functions-II	4	120	16	68	-	36
16	4MSCM4	Elective-II (Operation Research)	4	120	16	68	-	36

STUDY MODULES AND BOOKS INFORMATION

Sl. No.	Course Code	Title of the Course	Books / Module to be used
			SEMESTER I
1	1MSCM1	Advanced Abstract Algebra-I	Module Published by CVRU
2	1MSCM2	Real Analysis-I	Module Published by CVRU
3	1MSCM3	Topology-I	Module Published by CVRU

Sl. No.	Course Code	Title of the Course	Books / Module to be used
4	1MSCM4	Complex Analysis-I	Module Published by CVRU
			SEMESTER II
5	2MSCM1	Advanced Abstract Algebra-II	Module Published by CVRU
6	2MSCM2	Real Analysis-II	Module Published by CVRU
7	2MSCM3	Topology-II	Module Published by CVRU
8	2MSCM4	Complex Analysis-II	Module Published by CVRU
			SEMESTER III
9	3MSCM1	Functional Analysis-I	Module Published by CVRU
10	3MSCM2	Integral Transform-I	Module Published by CVRU

11	3MSCM3	Special Functions-I	Module Published by CVRU
12	3MSCM4	Elective-I (Advance Discrete Mathematics)	Module Published by CVRU
SEMESTER IV			
13	4MSCM1	Functional Analysis-II	Module Published by CVRU
14	4MSCM2	Integral Transform-II	Module Published by CVRU
15	4MSCM3	Special Functions-II	Module Published by CVRU
16	4MSCM4	Elective-II (Operation Research)	Module Published by CVRU

DATE SCHEDULE & INSTRUCTIONS FOR SUBMITTING ASSIGNMENTS

DUE DATE OF SUBMISSION OF ALL ASSIGNMENTS AT THE STUDY CENTRE		
Semester	Assignment No.	Due Date
First Semester	1MSCM1 1MSCM2 1MSCM3 1MSCM4	• April 30 (for January Session) • October 31 (for July session)
Second Semester	2MSCM1 2MSCM2 2MSCM3 2MSCM4	• October 31 (for January Session) • April 30 (for July session)
Third Semester	3MSCM1 3MSCM2 3MSCM3 3MSCM4	• April 30 (for January Session) • October 31 (for July session)
Fourth Semester	4MSCM1 4MSCM2 4MSCM3 4MSCM4	• October 31 (for January Session) • April 30 (for July session)

INSTRUCTIONS TO STUDENTS FOR FORMATTING THE ASSIGNMENTS
सत्रीय कार्य हेतु छात्रों के लिये निर्देश

1. This booklet contains the assignments for the entire (All Semester) programme. Each course has one assignment. All assignments should be completed and submitted at IODE CVRU/ study centre before the due date.

इस पुस्तिका में पूरे पाठ्यक्रम के लिये (सभी सेमेस्टर) के सत्रीय कार्य दिये गये हैं। प्रत्येक पाठ्यक्रम के लिये एक सत्रीय कार्य दिया गया है जिसे पूर्ण करने के पश्चात निर्धारित तिथि तक डॉ. सी. वी आर.यु के दूरस्थ शिक्षा संस्थान ⁄ अध्ययन केन्द्र को भेजना आवश्यक है।

2. Please note that you will not be allowed to appear for the Term End Examinations for the course, until the assignments are submitted before the due date.

कृपया ध्यान रहे जब तक सत्रीय कार्य निर्धारित तिथि तक जमा नहीं होंगे, आप सत्रांत परीक्षा में नहीं बैठ सकेंगे।

3. The assignments constitute the continuous component of the evaluation process and have 30% weightage in the final grading. You need to score minimum marks as per Examinations Scheme of Particular Programmme in assignment in each course in order to clear the continuous evaluation component.

सत्रीय कार्य सतत् मूल्यांकन का महत्वपूर्ण अंग है एवं अन्तिम ग्रेडिंग में 30 प्रतिशत अंक निर्धारित हैं। सतत् मूल्यांकन में उत्तीर्ण करने हेतु प्रत्येक सत्रीय कार्य में संबंधित कार्यक्रम के परीक्षा योजना के अनुसार न्यूनतम अंक प्राप्त करना अनिवार्य है।

4. The assignment should be hand written on a A-4 size paper with proper cover which contains all the required information as given on the next page. You can use the photocopy of the cover for each assignment.

सत्रीय कार्य ए–4 साइज पेपर पर हस्तलिखित होना चाहिए तथा उस पर अगले पृष्ठ पर दिये गये कवर के अनुसार सभी जानकारी लिखी होनी चाहिए। (आप चाहें तो कवर की फोटोप्रति प्रत्येक सत्रीय कार्य पर लगाकर प्रयुक्त कर सकते हैं)

5. Leave at least 4cm margin on the left, top and bottom of your answer sheets for the evaluator's comments.

प्रत्येक पृष्ठ पर बायें, ऊपर एवं नीचे कम से कम 4 सें.मी. जगह छोड़ें जो मूल्यांकनकर्ता अपनी टिप्पणी के लिये प्रयोग करेगा।

6. Your answers should be brief, precise and in your own words. Please do not copy the answers from the study material.

सत्रीय कार्य के प्रश्नों के उत्तर संक्षेप, स्पष्ट एवं स्वयं के शब्दों में होना चाहिए। उत्तर स्टडी मटेरियल की कॉपी नहीं होना चाहिये।

7. Please do not copy the assignment from other student.

कृपया सत्रीय कार्य दूसरे छात्र से कॉपी न करें।

8. While solving the questions, clearly indicate the question number along with the part being solved. Recheck your work before submitting it.

प्रश्नों के उत्तर लिखते समय, प्रश्न संख्या अथवा उसके भाग का स्पष्ट उल्लेख करें। सत्रीय कार्य जमा करते समय एक बार पुनः जांच कर लें।

9. You may retain a copy of your assignment response to avoid any unforeseen situation.

सत्रीय कार्य की एक प्रतिलिपि अपने पास रखें ताकि किसी अनहोनी घटना से बचा जा सके।

10. You can resolve the difficulties you may face while studying the course material by sending an e-mail to Programme coordinator IODE CVRU/ study centre coordinator. However, the coordinator will not provide solutions to the assignment questions, since they constitute an evaluation component.

पाठ्यक्रम सामग्री के अध्ययन के समय यदि कोई कठिनाई होती है तो उसके निराकरण हेतु कार्यक्रम समन्वयक दूरस्थ शिक्षा संस्थान डॉ. सी. वी. रामन् विष्वविद्यालय ⁄ अध्ययन केन्द्र के समन्वयक से ई–मेल द्वारा संपर्क किया जा सकता है। परंतु समन्वयक सत्रीय कार्य के प्रश्नों के उत्तर नहीं देंगे क्योंकि ये मूल्यांकन पद्धति के अंग हैं।

Note: Assignments of the course are available for download at the CVRU Website http://www.cvru.ac.in . You can download the assignments as per your course, follow the instructions given and submit it before due dates at the IODE CVRU/study centre.

<u>Note</u>