Semester-I

CENTRAL UNIVERSITY OF HIMACHAL PRADESH
[ESTABLISHED UNDER THE CENTRAL UNIVERSITIES ACT 2009]
PO BOX: 21, DHARAMSHALA, DISTRICT KANGRA – 176215
(HP)
www.cuhimachal.ac.in

Course Code: MTH 502 **Credits:** 4
Course Name: OPERATIONAL RESEARCH

Name of Teacher: Dr S. K. Srivastava

Credits Equivalent: 04 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity /contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher–led activity and 15 hours of other workload such as independent individual / group work; obligatory / optional work placement; literature survey / library work; data collection / field work; writing of papers / projects / dissertation / thesis; seminars, etc.)

Course Objective: The purpose of this course is to acquaint the students with the operational Research which is mainly concerned with the techniques of applying scientific knowledge, besides the development of science and provides an understanding which gives the expert/manager new insights and capabilities to determine better solutions in his decision – making problems, with great speed, competence and confidence.

Attendance Requirements:
Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

Evaluation Criteria:
1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Counselling, Activities and Tutorials (CAT): 25%

i. Subjective / Objective Assignment: 10 %
ii. Numerical Assignments using programming: 10 %
iii. Presentations and Class Tests: 5 %

Course Contents:
Unit I:
Linear Programming Problem: Operations research & its scope, Necessity of operations research in industry. Introductions to Linear programming problems, General linear programming problems, Mathematical Formulation of L.P.P. and examples, Feasible, Basic feasible and optimal solutions, Extreme points. Graphical Methods to solve L.P.P., Simplex

Method, Big M Method, Two phase Method, Degeneracy, Unrestricted variables, unbounded solutions, Duality in L.P. P., fundamental properties of Dual problems, dual simplex method and Revised Simplex method.

Unit II :

Transportation Problem : Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

Assignment Problem : Formulation, Hungarian method for optimal solution, solving unbalanced problem and travelling salesman problem.

Unit III :

Games and Strategies : Two person zero sum games, maximin and minimax principle, games without saddle points – mixed stratigies, Graphic solution of 2Xn and mX2 games, Dominance property, General solution of mXn Rectangular games, limitations and extensions.

Unit IV : Queuing theory : Queueing systems, Queueing problem, Transient and steady states, Probability Distributions in Queueing systems. Poisson process (pure birth process), Properties of poissions arrivals, Exponential process, Markovian property, Pure death process, Service time distribution, Erlang service time distribution, Solution of Queueing Models.

Prescribed Text Books :

1. Kanti Swarup, P.K. Gupta and Manmohan(2004), Operations Research, Sultan Chand & Sons, 12th Edition.
2. Waynel Winston (2011), Operatios Research, Cenagage Learning India Pvt. Ltd.

Suggested Additional Readings :

1. S.D. Sharma (2004), Operations Research, Kedar Nath Ram Nath & Co. 14th Edition.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi (2005), "Operations Research", Pearson Education.
3. S. Kalavathy (2011), Operations Research, Vikas Publishing House, PVT Ltd. New Delhi.
4. P. Sankara Iyer(2008), "Operations Research", Tata McGraw-Hill, 2008.

Course Code: MTH-404 **Credits: 4**
Course Name: Abstract Algebra
Instructor Name: Dr Meenakshi

Credits Equivalent: 04 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity /contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher–led activity and 15 hours of other workload such as independent individual / group work; obligatory / optional work placement; literature survey / library work; data collection / field work; writing of papers / projects / dissertation / thesis; seminars, etc.)

Attendance Requirement:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must, failing which a student may not be permitted to appear in examination.

Evaluation Criteria:

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment: 25%
   - i) Assignments 20%
   - ii) Class participation 5%

Course Contents:

Unit I

Laws of Composition, Groups and Subgroups, Examples of Groups and Subgroups, Groups generated by a Set, Cyclic Groups, Order of an element of a Group, Cosets, Lagrange's theorem, Index of a Subgroup, Cycle decomposition of a Permutation. Homomorphisms, Isomorphisms, Automorphisms, Normal Subgroups, Quotient Groups, The Isomorphism theorems, the Correspondence Theorem, Direct Product of Groups.

Unit II

Group Actions, Examples of Group Actions, Orbit and Stabilizer of Group Action, Orbit and Stabilizer Formula, Cayley's theorem, Conjugacy Classes, Center of a Group, Centralizer of a

Subset, the Class Equation, Application of the Class Equation, the Center of a p-Group and related results, Simple Groups.

Unit III

Stabilizer and Normalizer of a Subgroup, the First Sylow theorem, the Second Sylow theorem, the Third Sylow theorem. Applications of Sylow Theorems, Definition of a Ring, Examples of Rings, Subrings, Homomorphisms of Rings, Kernel of a Homomorphism, Ideals, Ideal Generated by a Set, Principal Ideals.

Unit IV

Quotient Ring, Prime Ideals, Maximal Ideals, the Isomorphism theorems for Rings, the Universal Mapping Property of Quotient Rings, The Correspondence theorem, Dircet Product Rings, Integral Domains, Group of Units of a Ring, Associates, Irreducible Elements of Ring, Prime Elements of a Ring, Unique Factorization Domains, An Example of a Non-Unique Factorization Domain.

Prescribed Texts

(1) I.M. Isaac, Algebra: A Graduate Course, AMS (Graduate Studies in Mathematics), Indian Edition.

(2) Michael Artin, Algebra, Second Edition, PHI

(3) P. B. Bhattacharya, S.K. Jain and S. R. Nagpaul, Basic Abstract Algebra, Second Edition, Cambridge University Press.

Additional Text

(1) David S. Dummit and Richard M. Foote, Abstract Algebra, Third Edition, Wiley India
(2) Nathan Jacobson, Basic Algebra, Vol. 1, Hindustan Publishing Corporation, Delhi

Course Code: MTH-401 **Credits: 4**
Course Name: ORDINARY DIFFERENTIAL EQUATIONS
Instructor Name: Prof (Dr) Rakesh Kumar

Credits Equivalent: 04 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity /contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher–led activity and 15 hours of other workload such as independent individual / group work; obligatory / optional work placement; literature survey / library work; data collection / field work; writing of papers / projects / dissertation / thesis; seminars, etc.)

Course Objective: The purpose of this course is to acquaint the students with elementary differential equations.

Attendance Requirement:
Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must, failing which a student may not be permitted to appear in examination.

Evaluation Criteria:
1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment: 25%
   ii) Assignments 20%
   ii) Class participation 5%

Course Contents:

Unit I: Existence and uniqueness theory; dependence of solutions on initial conditions and on the function; existence and uniqueness theorems for systems and higher order equations.

Unit II: The theory of linear differential equations; homogeneous and non-homogeneous systems, nth order homogeneous and non-homogeneous linear differential equations.

Unit III: Sturm theory, Sturm-Liouville boundary value problems.

Unit IV: Nonlinear differential equations; phase plane, critical points and paths (linear and nonlinear systems), limit cycles and periodic solutions.

Prescribed Text Books:

1. Ross S.L. (1984). Differential Equations. Third Edition. John Wiley & Sons Inc.

Suggested Additional Readings:

1. W.E. Boyace and R.C. Diprima (2013). Elementary Differential Equations and Boundary Value Problems, Ninth Edition, Wiley.

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Course Code: MTH-403 **Credits: 4**
Course Name: LINEAR ALGEBRA
Instructor Name: Mr. Pankaj Kumar

Credits Equivalent: 04 Credits (One credit is equivalent to 10 hours of lectures / organised classroom activity /contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher–led activity and 15 hours of other workload such as independent individual / group work; obligatory / optional work placement; literature survey / library work; data collection / field work; writing of papers / projects / dissertation / thesis; seminars, etc.)

Course Objective: The purpose of this course is to acquaint the students with the Numerical analysis which is necessary to develop the basic understanding of numerical algorithms for solving problems in science, engineering and technology.

Attendance Requirement:
Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must, failing which a student may not be permitted to appear in examination.

Evaluation Criteria:
1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment: 25%
   iii) Assignments 20%
   ii) Class participation 5%

Course Contents:

Unit I: Vector Spaces, Subspaces, Basis and dimension, Linear Transformations, Quotient spaces, Direct sum, The matrix of a linear transformation, Duality

Unit II: Eigenvalues and eigenvectors, Annihilating polynomials, Invariant subspaces, Triangulation and diagonalization.

Unit III: Canonical Forms, Jordan Form, Inner Product Spaces, orthonormal basis, Linear functional and adjoints.

Unit IV: Bilinear Forms, Definition and examples, Symmetric and skew-symmetric bilinear forms.

Prescribed Text Book:

1. K. Hoffman and R. Kunze : Linear Algebra, Second Edition, Pearson, 2015.

Suggested Additional Readings:

1. G. Strang: Linear Algebra and its applications, 4th Edition, CENGAGE LEARNING, 2007.
2. S. Kumaresan: Linear Algebra, A Geometric approach, Prentice Hall of India, 2000.
3. S. Lipschutz and M. L. Lipson: Linear Algebra, 3rd Edition, McGraw Hill Education India, Pvt. Ltd., 2001.
4. H. Anton and C. Rorres: Elementary Linear Algebra, 11th Edition, Wiley, 2014.

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Skill Development

Course Name: Vedic Mathematics **Credit: 02**
Course Code: IAM 412
Instructor Name: Dr Pankaj Kumar

Course Objective: The purpose of this course is to acquaint the students with the quicker arithmetic techniques to solve problems.

Course Contents:

Unit I: Number system, binary system, permutation combination, probability.

Unit II: Ratio and proportion, partnership, percentage, average, profit and loss, allegation, time and work, time and distance.

Prescribed Text Book:

M. Tyra, Quicker Maths, BSC Publishing Co. Pvt. Ltd. Delhi, 2017.

Suggested reading:

J. Sankaracarya, Vedic Mathematics, Motilal Banarsidass Publishers Delhi 2015.

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Skill Development

Course Code: IAM-415 **Credits: 2**
Course Name: Elementary Number Theory
Instructor Name: Dr Meenakshi

Course Objective: The purpose of this course is to give a simple account of classical number theory.

Course Contents:

Unit-I: Mathematical Induction, Divisibility of Integers and simple properties. The Euclidean algorithm, The Diophantine equation, Primes and their distribution, Binary and Decimal representation of Integers.

Unit-II: The theory of Congruences, Linear Congruences, The Chinese Remainder Theorem, Number theoretic functions.

Prescribed Text Book:

1. David M. Burton, "Elementary Number Theory", Seventh Edition, McGraw Hill publication.

Suggested Additional Reading:

1. I. Niven, H. Zuckerman and H. Montgomery, "An Introduction to Theory of Numbers", Second Edition, John Wiley and Sons.
2. G. Hardy and E. Wright, "An Introduction to Theory of Numbers" Fifth Edition, Oxford University Press.
3. K. Ireland and M. Rosen, "A Classical Introduction To Modern Number Theory", Second Edition, Springer.