TIME SLOT DISTRIBUTION

	0930-1030	1030-1130	1130-1230	1400-1500	1530-1630
MONDAY	1A	2A	3A	4A	5A
TUESDAY	2B	3B	4B	5B	6B
WEDNESDAY	3C	4C	5C	6C	7C
THURSDAY	6A	7A	8A	1B	SEMINAR
FRIDAY	7B	8B	1C	2C	8C

TIME TABLE FOR COURSES

COURSE No.	COURSE TITLE	INSTRUCTOR	SLOT	VENUE
MIS (CMMACS): 3-107 ENG (CMMACS): 2-423	Advanced Numerical Techniques (3 Credits)	VS	1	CCR 1
MIS (C-MMACS): 3-113 ENG (CMMACS)-2-417	Finite Element Method (3 Credit)	PS	3	CCR 1
PHY (CMMACS) 3-247	GNSS (Global Navigation Satellite Systems) Remote sensing and Geodesy	MSMV	5	CCR 1
MIS (CMMACS): 3-115	Statistical Physics and its Practical Applications (3 Credits)	VKG	8	CCR 1
MIS (C-MMACS): 3-111 PHY (CMMACS): 3-247 ENG (CMMACS): 3-001	Advanced Self Study on Special topic (4 Credit)	PhD Guide		CCR 1
MIS (C-MMACS): 4-104 PHY (CMMACS): 4-002 ENG (CMMACS): 4-002	Project Proposal and Review Article (one each of 2 credits)	PhD Guide		CCR 1

Course Coordinators:

PS – Prof P Seshu **VKG – Prof V K Gaur**
VS – Mr V Senthilkumar **MSMV – Dr M S M Vijayan**

ACADEMIC CALENDAR (August 2012 Session)

Last Date for Submission of Course Registration Forms	8th August 2013
Instruction Begins	12th August 2013
Last Date for ADD/DROP courses	19th August 2013
Mid-Semester Examinations	7-11 Oct. 2013
Session ends	6 Dec. 2013
End-Semester Examinations	16-20 Dec. 2013
Last Date for Submission of Grades	27 Dec. 2013

Course Details

ENG(CMMACS)-2-417 & MIS (C-MMACS): 3-114: Finite Element Method: 3-0-0-3

Course Coordinator - Prof P Seshu

Approximate solution of linear differential equations -- Weighted residual techniques. Collocation, Least Squares and Galerkin methods. Use of piecewise continuous approximation functions. Basis of Finite Element Method. Formulation of element level equations and assembly into system level equations. One dimensional example problems.

Elements of Variational calculus. Minimisation of a functional. Principle of minimum total potential. Piecewise Rayleigh --- Ritz method and FEM. Comparison with weighted residual method. Two dimensional finite element formulation. Isoparametry and numerical integration. Finite element formulation for transient dynamic problems. Algorithms for solution of equations.

Recommended Books

1. Bathe, K. J., Finite element procedures in Engineering Analysis, Prentice Hall of India, 1990.
2. Cook R.D., Malkus. D. S., Plesha M. E. and Witt R. J, Concepts and Application of Finite Element Analysis, 4th Ed., John Wiley, 2005.
3. Huebner K. H., Dewhirst D. D., Smith D. E. and Byrom T. G., The Finite Element Method for Engineers, John Wiley, New York, 2004.
4. Reddy J. N., An Introduction to the Finite Element Method, 3rd Ed., Tata McGraw Hill, New Delhi, 2005.
5. Seshu P., Finite Element Analysis, Prentice Hall of India, 2003.
6. Zienkiewicz, O. C., and K. Morgan, Finite elements and approximation, John Wiley, 1983.
7. Zienkiewicz O. C, Taylor R. L. and Zhu J Z., The Finite Element Method: Its Basis and Fundamentals, 6th Ed., Elsevier, 2005

MIS (C-MMACS): 3-116: Statistical Physics and its Practical Applications: 3-0-0-3

Course Coordinator – Prof V K Gaur

Most Emergent (sudden appearance at some stage of evolution) phenomena in Physical, social, industrial and environmental arenas are the integral result of a host of interacting processes at varying space and time scales, and are therefore inherently stochastic. The principal challenge in dealing with such phenomena lies in our ability to reliably estimate the Canonical states of a composite system required both for enhancing our understanding of the critical stages preparatory to their emergence as well as for designing resilient mitigative measures to minimize heir adverse impacts, if any. The concepts and methodologies of Statistical Physics open up illuminating analytical approaches to addressing a host of s problems related to such emergent phenomena: Atmospheric and ocean eddies, earthquakes, epidemics, financial market crashes, to name a few. It is accordingly proposed to design and deliver a course on STATISTICAL PHYSICS AND ITS PRACTICAL APPLICATIONS as a component of the AcSIR programme. The following is a first cut statement of course content which would form the basis for a more detailed and more evocatively addressed context that would subsequently be brainstormed and honed.

Course Contents:

1. Statistical methods: random variables, random functions, distributions, random walk, limit theorems
2. Statistical physical systems: Microscopic state of classical and quantum system, fundamental postulates of statistical mechanics, ergodic theorem
3. Microcanonical ensembles, thermal and mechanical interaction between to microscopic systems, connection between microcanonical ensemble and thermodynamics, classical monatomic gases
4. Canonical ensemble: Einstein solid, particles with two energy levels, Boltzmann gas
5. Classical gas in canonical formalism: Ideal monatomic gas, Maxwell---Boltzmann distribution, partition function, equipartition of energy, classical monatomic gas of particles
6. The grand canonical and pressure ensembles: pressure ensemble, the grand canonical ensemble
7. Phase transition and critical phenomena: Simple fluids. Van der Wall's equation, Landau phenomenology
8. The Ising model: Exact solution in one dimension, mean field approximation for the Ising model, The Curie---Weiss model, The Bedther-Peierls approximation
9. Scaling theories and the renormalization group: scaling theory of thermodynamic potentials, scaling of the critical correlations, The Kadanoff construction, Renormalization of iIsing model, The general scheme of the renormalization group
10. Nonequilibrium phenomena: Boltzmann's kinetic equation, BBGKY hierarchy, Brownian motion, Langevin equation, The Fokker---Plank equation, the master equation, the kinetic Ising equation, the Monte Carlo method
11. Porous media: Relating heat, mass balance and momentum at pore scale to watershed, environmental applications
12. Data-driven modeling using statistical physics methods in nonlinear and multiscale systems: earthquakes, atmospheric instabilities, epidemics etc.

Books:

Salinas, SRA,. Introduction to Statistical physics, Springer, 2004. Huang, K. Statistical mechanics, J Wiley, 1987 Chandler, D. Introduction to modern statistical mechanics, Oxford Univ Press, 1987 Honerkamp, J. Statistical physics, Springer, 2002.65

MIS (C-MMACS): 3-107, ENG (CMMACS): 2-423

Advanced Numerical Techniques (2-1-0-3)

Course Coordinator – Mr V Senthilkumar

Ordinary Differential Equations: Initial Value Problems: Single step methods, Multi step methods Boundary Value Problems: Shooting Method, Finite Difference Methods, Finite Element Method

Partial Differential Equations: Finite Difference Discretization, Finite difference treatment of 2nd order nonlinear PDE of parabolic, elliptic types, Hyperbolic problems

Higher Order Methods: Spectral Method, Pesudospectral Method

Recommended Books:

5. Numerical Methods for Scientific and Engineering Computation– M.K.Jain, S.R.K.Iyengar and R.K.Jain, New Age International Publishers

6. Computational Methods for Partial Differential Equations– M.K.Jain, S.R.K.Iyengar and R.K.Jain, New Age International Publishers

7. Numerical Methods for Engineers and Scientists- Joe D. Hoffman, McGraw- Hill, Inc

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PHY (CMMACS) 2-247
GNSS (Global Navigation Satellite Systems) Remote sensing and Geodesy (2-1-0-3)
Course Coordinator – Dr M S M Vijayan

This unique advanced level course deals with the theory and practice of using Global Navigation Satellite Systems (GNSS) as a remote sensing as well as geodetic tool. The growing number of GNSS navigation satellites which includes US Global Positioning System(GPS) provide an opportunity to use its signals for remote sensing. The delay in signal propagation caused by various parts of atmosphere can be inverted to quantify the causative atmospheric parameters like Tropospheric Precipitable Water Vapour(TPWV) and Ionospheric Total Electron Content(TEC). In addition the reflection of the GNSS signals can be used to measure various parameters viz. Soil moisture, ocean altimetry, etc. Recent research in this area are showcasing the possibility of using GNSS as first ever tool to remotely sense the seismic signals and Tsunami waves in open ocean. It has also been well proved from the research outcomes of last one decade that the GNSS is a solid tool for geodetic studies.

This course will be useful for those aspiring to set their carrier in this emerging research frontier as well as for engineers who are interested towards improving the positioning accuracy in navigation, communication and mobile telephone applications.

Syllabus: Chapter I: Principles of satellite navigation – GNSS satellite Systems and its configuration – Signal Structure – Receiver basics and signal processing – Reference Systems

Chapter II: Positioning: Observables – Code and phase measurements – Signal propagation – Cycle slips correction – Ambiguity resolution – Differential Code Biases(DCB) – Mathematical models for positioning – Network Adjustment

Chapter III: Structure of the Ionosphere – Ionospheric refraction and delay – Estimation of

TEC from ionospheric delay – Ionospheric correction for positioning – detection ionospheric anomalies – detection of ionospheric precursors to earthquakes – detection of Travelling Ionospheric Disturbances (TID) – Perturbations associated with Acoustic Gravity Waves(AGW) induced by seismic Rayleigh wave and Tsunami propagation

Chapter IV: Structure of Troposphere – Effect of Troposphere on Signal propagation – Estimation of TPWV from Tropospheric delay – Tropospheric correction in positioning – GNSS signal reflection and its applications

Chapter V: GNSS Data processing: GAMIT/GLOBK for positioning, TPWV estimation from GPS data, TEC estimation and detecting TID and AGW

References:

1.GPS Theory and Practice – B.Hofmann-Wellenhof, H.Lichtenegger and J. Collins, SpringerWien, New York 2.GPS Satellite Surveying – Alfred Leick, Wiley 3. Linear Algebra, Geodesy and GPS – Gilbet Strang and Kai Borre, Wellesley-Cambridge Press

4. GNSS – Global Navigation Satellite Systems: GPS, GLONASS, Galileo & more By Bernhard Hofmann-Wellenhof, Herbert Lichtenegger, Elmar Wasle, SpringerWien, New York

5.GPS for Geodesy, Peter J.G. Teunissen (Editor), Alfred Kleusberg (Editor), Springer

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MIS (C-MMACS): 3-103, PHY (CMMACS): 3-247 & ENG (CMMACS)-3-001

Advanced Self Study on Special topic (0-2-6-4)

Course Coordinator – PhD Guide

Aims to train the student on learning, on one's own, topics that are not formally taught in a course. This would involve primarily three components - collection of relevant literature on a chosen topic, organization of relevant material into a written report based on candidate's own critical understanding and finally presentation of the findings in front of wide audience in the form of a seminar. Thus communication skills are also expected to be honed up.

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MIS (C-MMACS): 4-104, PHY (CMMACS): 4-002 & ENG (CMMACS)-4-002

Project Proposal and Review Article (0-2-6-4)

Course Coordinator – PhD Guide

One subject proposals to be prepared before comprehensive examination by selecting topics of high relevance and novelty, and will have state-of-the art review, methodologies, recommendations etc and review article on a special topic in the area of research. (2 credits each)

PhD Program of CSIR CMMACS under AcSIR – Session August 2013

COURSE REGISTRATION FORM

Student's Name :

Roll No.:

Thesis Supervisor:

COURSE DETAILS:

COURSE NUMBER	COURSE TITLE	INSTRUCTOR	SLOT	L-T-P-C

Sd/-

(Student) (Supervisor) (AcSIR Coordinator)