।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

Phone: (02462) 229542
Fax : (02462) 229574

Website: www.srtmun.ac.in

E-mail: bos.srtmun@gmail.com

प्रस्तुत विद्यापीठीय संकुलातील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील M. Phil. अभ्यासक्रमाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७–२०२० च्या ठरावानुसार प्रस्तुत विद्यापीठीय संकुलातील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील M. Phil. अभ्यासक्रमाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्यात येत आहेत.

01. M.Phil. - Geology
02. M.Phil. - Geography
03. M.Phil. – Environmental Science
04. M.Phil. – Computer Sceicne (Common To Camus & Sub Campus)
05. M.Phil. – Chemistry
06. M.Phil. – Physics

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदव्युत्तर(संकुल)–सीबीसीएस अभ्यासक्रम/२०२०–२१/५९१

दिनांक : २४.०८.२०२०.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) मा. संचालक, सर्व संबंधित संकुले, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MATHAWADA UNIVERSITY, NANDED

M. Phil Physics (Campus School) Syllabus

(Effective from the Academic Year 2020-2021)

Disclaimer

*Syllabus of **M. Phil. Physics (Campus School)** given in this document was prepared following requirements of **UGC, New Delhi,** and has been duly approved by the **Faculty of Science and Technology, the Academic Council** and the **Management Council** of **S.R.T.M. University**. The same has been implemented from the academic year **2020-2021**.*

The Board of Studies in Physics of S. R. T. M. University, Nanded is as follows

Dr. M. K. Patil, ***Chairman, BOS*** ***Director and Professor,*** School of Physical Sciences, S.R.T.M. University, Nanded Contact No. 08308298063 Email: patil@associates.iucaa.in	**Dr. S. N. Keshatti,** Department of Physics, Shivaji Mahavidyalaya, Parbhani Contact No. 9422743448 Email: keshatti.shrinivas@gmail.com
Dr. K. S. Kanse, Department of Physics, Lal Bahaddur Shahstri Mahavidyalaya, Dharmabad, Dist. Nanded Contact No. 09850924426 Email: kskanse@gmail.com	**Dr. P. R. Mirkute,** Department of Physics, Yeshwant Mahavidyalaya, Nanded Contact No. 09420846627 Email: pravinmirkute@gmail.com
Dr. P. G. Gawali, Department of Physics, Bahirji Smarak Mahavidyalay, Basmath, Dist. Hingoli Contact No. 09421387622 Email: pggawali_123@rediffmail.com	**Dr. H. V. Bakshi,** *Head,* Department of Physics, Arts, Commerce & Science College, Shankarnagar,Tq.Biloli,Dist. Nanded Contact No. 09860058507 Email: hvbakshi@rediffmail.com
Dr. B. D. Achole, Department of Physics, Shri Havagiswami College, Udgir, Dist. Latur Contact No. 09422652892 Email: b_achole1234@rediffmail.com	**Dr. B. S. Munde,** *Head,* Department of Physics, Katruwar Arts, Ratanlal Kabra Science & B.R.Mantri Commerce College, Manwath, Dist. Parbhani Contact No. 008668413490 Email: bhaskarmunde@yahoo.com
Dr. S. D. Misal, *Head,* Department of Physics, Shri. Kumarswami Mahavidyalaya, Ausa, Dist. Latur Contact No. 09403244677 Email: misalsubhash31@rediffmail.com	**Dr. A. S. Chaudhari,** Professor, Department of Physics, Govt. Vidarbha Institute of Science, Amravati Contact No. 09421869109 Email: ajaychau5@yahoo.com
Mr. Dayanand Mane, Yog Kunj, 15, Sudashan Nagar, Pipri Meghe, Wardha Contact No.	**Dr. K. M. Jadhav,** *Professor,* Department of Physics, Dr.B.A.M.University, Aurangabad Contact No. 09422686061 Email: drjadhavkm@gmail.com
Dr. Tarun Sourdeep Ghosh, *Professor H,* IUCAA, Ganeshkhind, Pune Contact No. 020 25604212 Email: tarun@iucaa.in	**Dr. A. G. Bidwe,** Professor & Registrar, Sharanbasawa University, Kalburgi, Karnataka Contact No. 09243219188, email: agbidve@gmail.com
Ms. Aishwarya V. Patil, *Invitee Member, Students Representative (UG)*	**Mr. Nand Kiran Kishor,** *Invitee Member, Students Representative (PG)*

Syllabus of **M Phil Physics** given in this booklet was prepared by the faculty of the School of Physical Sciences, S.R.T.M. University, Nanded following model curriculum proposed by UGC, New Delhi and looking at the needs of the students to compete with the recent trends in higher education at national and international level. The same has been finalized by inviting comments, suggestions from experts from various universities, institutes, industries and alumni of the School, which was then approved by the regular **Board of Studies (BOS) in Physics**, the **Faculty of Science & Technology**, and the **Academic Council of the University**. Following members were invited for preparing draft of the syllabi of various courses:

Dr. M. K. Patil, ***Director,*** Professor, School of Physical Sciences, S.R.T.M. University, Nanded Contact: 08308298063 Email: patil@associates.iucaa.in	**Dr. R. S. Mane,** ***Professor,*** School of Physical Sciences, S.R.T.M. University, Nanded Contact No. 07447295802 Email: rajarammane70@gmail.com
Dr. A. C. Kumbharkhane, ***Professor,*** School of Physical Sciences, S.R.T.M. University, Nanded Contact No. 09421869112 Email: akumbharkhane@yahoo.co.in	**Dr. Mrs. M. P. Mahabole,** ***Professor,*** School of Physical Sciences, S.R.T.M. University, Nanded Contact No. 09421850549 Email: mpmsrtmunsps@gmail.com
Dr. A. V. Sarode, ***Asst. Professor,*** School of Physical Sciences, S.R.T.M. University, Nanded Contact No. 09921340727 Email: avsarode@gmail.com	**Dr. K. A. Bogle,** ***Asst. Professor,*** School of Physical Sciences, S.R.T.M. University, Nanded Contact No. 07350845827 Email: kashinath.bogle@gmail.com

Master of Philosophy (M. Phil.) in Physics

(***With effect from June 2020***)

1. **Content**

a) The M. Phil. Course in Physics comprises four theory papers of hundred (100) marks each. (This includes 75 marks of University examination (UE) and 25 marks of Internal examination (IE) for each paper. The inter assessment / examination will be in the form of two tests / tutorials each of 10 marks and one seminar of 05 marks.

b) The School shall communicate the scores of the candidates in internal examinations the University before the final examination.

c) M Phil dissertation will carry 100 marks. Every student shall be required to submit three copies of his dissertation work to the Board of Examination and Evaluation (BEE) through the School, which will then be evaluated from an external examiner (from other university). The external examiner will send report of the dissertation adjudication along with score out of 100. Based on evaluation report the BEE will request the Director of the School to conduct final Viva-Voce of the candidate. Following to which, the School Director will fix M Phil Viva-Voce examination of the concerned candidate. Examiners for this Viva-Voce examination with be comprised of the Director (chairman), guide and at least two faculty members from the School. Based on the performance, this examination panel will assess the performance of the candidate and each examiner will assign marks out of 100. Average of the marks allocated by all the members will be sent to the BEE with a recommendation for the award of M. Phil in Physics.

d) The M. Phil. course is of 600 marks.

i) Four theory papers each of 100 marks

ii) One dissertation of 100 marks

iii) Viva-Voce of 100 marks

e) Dissertation topic of the candidate will be finalized by the guide allocated at School level.

2. a) The M. Phil. examination shall be held in the month of April/May every year.

b) Those candidates who failed in the examination held in April/May in any theory on internal paper will be allowed to appear for the examination which will be held in next April/May.

c) The candidate shall be allowed to submit the dissertation before or after theory examination.

d) If the candidate fails to clear the M. Phil. theory or internal papers within the stipulated period, he/she should appear for the theory or internal examination only as a repeater. However, the result of dissertation will be carried forward.

e) The candidate has to submit dissertation within one year after the theory examination. The candidate must complete the whole course within two years from the date of registration for M. Phil.

3. **Medium of instructions and examinations:** The medium of instructions and examinations will be English.
4. A regular faculty member of the School with Ph.D. in Physics is eligible to guide M Phil dissertation.

5. Standard of Passing:

a) The assessment of the candidates shall be in grades on the seven point scale. The candidate must score at least 'B' grade in every paper and in his/her dissertation and viva-voce in the aggregate. He/She should get minimum 'B' grade for being eligible for the award of M.Phil. Degree.

Marks Obtained %	Grade	Grade Points
100-90	A++	10
89-80	A+	9
79-70	A	8
69-60	B++	7
59-55	B+	6
54-50	B	5
49 and less	C	0

A student with 'C' grade in a paper would be disqualified for getting a credit for that paper. The student will however be permitted to reappear for the said paper.

b) The average grade point for each paper or dissertation will be calculated upto two places of decimals.

c)

The final result will be declared by working out the overall grades of (a) Written examination (b) Internal (c) Dissertation and (d) Viva-Voce.

6. Procedure for Evaluation of Dissertation:

The 48(3) Committee of the concerned subject in consultation with the guide shall submit a panel of referees consisting of at least 05 qualified teachers from outside universities and research institutes, from which the Vice-Chancellor will appoint any teacher of his choice as the referee.

7. Admission Preferences:

The candidates who have completed their M Sc Physics from any of the UGC approved universities are eligible for admission to M Phil Physics./ However, they need to qualify / clear the M Phil Eligibility Test (MPET) conducted by Swami Ramanand Teerth Marathwada University, Nanded. Distribution of the seats shall be as follow:

a) Candidates from S.R.T.M. University will be admitted for 70% of the available seats.

b) Candidates from other universities from within Maharashtra will be admitted for 30% of the available seats.

c) Candidates from other states and overseas will be admitted on the over and Above quota as specified by the University.

In case of number of qualifying candidates from SRTMU is less than the available seats, those seats will be filled in from among the candidates from other universities from Maharashtra.

(Prof. M. K. Patil)
Professor and Director,
School of Physical Sciences
Chairman
Board of Studies in Physics

Course Structure and Marking Scheme of M. Phil. Physics

Paper Code	Paper Title	Credits	Contact Hours	Assessment pattern (marking scheme)		
				Internal Assessment (T1-10+T2-10+HA-5)	Final Examination	**Total Marks**
MPH 101	**Research Methodology**	**04**	**60**	**25**	**75**	**100**
MPH 102	**Information Technology**	**04**	**60**	**25**	**75**	**100**
MPH 103	**Methods in Theoretical Physics**	**04**	**60**	**25**	**75**	**100**
MPH 104	**Methods in Experimental Physics**	**04**	**60**	**25**	**75**	**100**
MPH 105	**Dissertation**	**04**	**Two Semesters**	**--**	**100**	**100**
MPH 106	**Viva-Voce**	**04**	**--**	**--**	**100**	**100**
MPH 107	**Seminar**	**01**	**15**	**--**	**25**	**25**
Total		**25 credits**	**---**	**---**	**---**	**625**

MPHY 101 – Research Methodology

Credits: **04**	*Contact Hours*: **60** *(L+T+R)*	*Total Marks:* **100** **[MSA: 25** (*T1+T2+HA=10+10+050)*; **ESA=75]**

Learning Objectives:

- To enable the student to understand and work with methods and concepts related to research.
- To enable the student to develop research proposal and to work on research problem.
- To develop broad comprehension of research area.

Unit-I : Introduction **15**

Meaning, concept, nature steps, and their characteristics. Approaches and theories of paradigm and theirs implications in research. Philosophical and sociological foundations of research. Interdisciplinary approach and its implications in various research area.

Unit-II : Methods of Research **15**

Qualitative and quantitative methods of research like. Historical, caste study, ethnography, ex post facto, documentary and content analysis, survey (Normative, descriptive, evaluative etc.) field and laboratory experimental studies. Characteristics of methods and their implications in research area.

Unit-III : Development of Research Proposal **15**

Research proposal and its elements. Formulation of research problem-criteria of sources and definition. Development of objectives and characteristics of objectives. Derivation and operational of variables. Developing assumptions and applications

Unit-IV : Methods of Data Collection **15**

Concept of sampling and other related to sampling.Probability and non-probability samples, their characteristics, and implications. Tools of data collections, their types, attributes, and uses. Redesigning, research tools like-questionnaire, opinnaire, observation, interviews, scales, and tests etc.

Unit-V : Methods of Data Analysis **15**

Analysis of qualitative data based on various tools. Analysis of quantitative data and it presentation with tables, graphs etc. Statistical tools of data analysis – measures of central tendency, dispersion, relative position etc. Decision making with hypothesis testing through parametric and non-parametric tests. Validity and delimitations of research findings.

Unit-VI : Report Writing and Evaluations **15**

Principles of report writing and guidelines according to style manuals. Writing and presentation of preliminary, main body and reference section of report. Evaluation of research report. Home Assignment: How to submit research proposals? How to file patents?

Reference

• Kothari, C.F. (2005) Quantitative Techniques, New Delhi, Vikas Publishing House.
•Gautam, N.C. (2004) Development of Research Tools, New Delhi, Shree Publishers.
• Gupta, Santosh (2005) Research Methodology and Statistical Techniques, Deep and Deep Publications.
• Chandra, A. and Saxena T.P. (2000) Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
• Shukla, J.J. (1999) Theories of Knowledge, Ahemadabad, Karnavati Publication.
• Bhattacharya, D.K. (2004) Research Methodology, New Delhi, Excel Books.
• Brymann, Alan and Cramer, D. (1995) Qualitative Data Analysis for Social Scientist, New York, Routledge Publications.
• Best, J.W. and Khan J.V. (2005) Research Introduction, New Delhi, PHI
• Creswell J.W. (1994) Qualitative Approach, New Delhi, Sage Publication.

Books:

1. Research Methodology - C. R. Kothari
2. Research Methodology : An Introduction - Stuart Melville and Wayne
3. Practical Research Methods - Catherine Dawson

MPHY 102 – Information Technology

Credits: **04**	*Contact Hours*: **60** *(L+T+R)*	*Total Marks:* **100** **[MSA: 25** (*T1+T2+HA=10+10+050)*; **ESA=75]**

Learning Objectives:

- To enable the student to understand the importance of information technology in every day life and also in research
- To enable the students to understand the difference between hardware, software, and different types of operating systems
- To enable the student to use application softwares for report writing, data handeling, sampeling, etc.
- To learn how to use information technology for effective and prompt communication.

Unit-I Knowing basics of computers for research applications **10**

Unit-II Introduction of Operating Systems **10**
i) MS Windows ii) Linux

Unit-IIII Introduction to Software **10**
i) Application Software ii) Software related to research

Unit-IV Using Internet for Research **15**
i) Internet ethics and information reliability ii) Finding authenticated information on www iii) Finding research related sources on www iv) Knowing research journals on www

Unit-V Introduction to research related software **10**
i) Statistical data analysis software : SPSS, MS-Excel
ii) Core calculations software : Mata-lab iii) GIS

Unit-VI Developing utility programs for research **10**
Programming languages C, Fortran

Unit-VII Research related tools and utilities **15**
i) Research publishing tools : MS-Word, Adobe Acrobat, LaTex etc.
ii) Graphic Tools : MS-Excel (Graphs), Hayward Graphics
iii) Presentation tools MS-PowerPoint
iv) Subject/field specific research tools on WWW (Freeware)

Unit-VIII Introduction to advance research IT related technologies **10**
i) Simulation ii) Modeling iii) Cluster Computing Home Assignment : Study of at least two softwares associated with concern subject.

Reference

1) Search internet for appropriate information and references.
2) Computer Fundamentals – Pradip K. Singh & Priti Singha
3) The Internet : A users guide – K.L. James (PHI)
4) Internet Research Skill-Niall O' Dochartanish (Sage Publication)
5) MS-Office (2003) Edition (PHI)
6) Programme in 'C' – E. Balagurusamy
7) Principles of Remote Sensing & Image Interpretation-Lilly Sand & Keifer (Tata McGraw Hill)
8) GIS – Harbert R. Mann.

MPHY 103 – Methods in Theoretical Physics

Credits: **04**	*Contact Hours*: **60** *(L+T+R)*	*Total Marks:* **100** **[MSA: 25** (*T1+T2+HA=10+10+050)*; **ESA=75]**

Learning Objectives: *Objective of the course is to introduce the students to various mathematical methods that are needed for understanding and deriving various aspects of Physics. This course is also aimed to develop knowledge in mathematical physics and its applications, to develop expertise in mathematical methods required for research methods, to develop critical thinking and problem solving skill, to enable the students to formulate, interpret and draw inferences from mathematical solution. This course also enables the students to get introduced to the useful numerical methods and tools that are being adopted for handeling data in Physics.*

UNIT-I:Error Analysis **(12 Hours)**

Introduction, lest square fitting, covariance & Correlation, The binomial and Poisson distribution, The X square test

UNIT-II:Complex Analysis **(12 Hours)**

Complex numbers complex functions (polynomials, exponential Trigonometric complex functions. Logarithm) Limits and continuity, differentiation analytical functions Cauchy-Riemann conditions rectifiable arcs line integrals, Cauchy's theore, Cauchy integral formula, derivatives of analytical functions. Lowville theorem, power series Taylor's theorem Laurent's theorem. Calculus of residues evaluation of real definite theorem Laurent's theorem. Calculus of residues evaluation of real definite integrals, summation of series, and elementary discussion of branch cuts.

UNIT-III: Mathematical Methods **(12 Hours)**

Application of vector calculus in classical mechanics and electrodynamics. Vector spaces and operator algebra, matrices and their application in quantum mechanics, Linear first order and second order differential equations in physics, Fourier series, Fourier and Laplace transforms, Complex analysis its applications in evaluating integrals.

UNIT-IV: Classical Mechanics **(12 Hours)**

Lagrange's and Hamiltonian Formalisms, Conservation theorems and symmetry properties, Two – body central force problem – reduction to one body problem, scattering in a central force field. Small oscillations, orthogonal transformations, Eulerian angles, Rigid body motion.

UNIT-V: Interpolation **(12 Hours)**

Linear Interpolation, polynomial interpolation, difference tables, Gregory-Newton Interpolation, Backward differences, Errors in differences. Numerical Integration:Trapezoidal Rule, Simpson's Rule, Newton's 3/8 th rule, GaussionQuadrature. Solutions of Differential Equations:-Solution by Taylor series, Euler's Mehtod Predictor Corrector Mehtod, Runge-Kutta Method.

Reference Books:

1. A. W. Joshi, Matrices and Tensors in Physics,
2. Mathematical Physics, B. S. Rajput
3. Higher Engineering Mathematics, By B. S. Grewal.
4. Mathematical Physics, S. L. Kakani.
5. H. M. Antia: Numerical methods for scientists and engineers.
6. Vetterming, Teukolsky, press and Flannery: Numerical recipes.
7. Sastry: Introductory method of numerical analysis.
8. Rajaraman: Numerical analysis.
9. Classical Mechanics by J. C. Upadhyaya, Himalaya Publishing House, New Delhi
10. Classical Mechanics by V. B Bhatia, Joag, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi
11. Classical Mechanics by P. V. Panat, Joag, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi

MPHY 104 – Methods in Experimental Physics

Credits: **04**	*Contact Hours*: **60** *(L+T+R)*	*Total Marks:* **100** **[MSA: 25** *(T1+T2+HA=10+10+050)*; **ESA=75]**

Learning Objectives: *This course is aimed to introduce the students to the advanced courses in Physics with an analogy to enable them to identify the importance and thrust areas in research. This course heplps them to develop the skills related to the research areas centered on Signal processing, Vacuum Science, Stellar astrophysics and Spectroscopic Processes.*

Unit I. Signal- processing (15 Hours)

Analog to digital and digital to Analog converters, amplifiers multiplexers, samples and hold circuits, data filtering concepts of digtal filters interfacing with microprocessors. Time and frequency domain analysis spectrial analysis, random signals auto and dross correlation transfer function of system etc.

Unit II. Vacuum physics and Technolog (15 Hours)

Nature of gas flow, Trubulent flow, Viscous laminar flow molecular flow, flow relationship, Conductance (Series & parallel) Equation for viscous flow (Circular &Retangular duct) and molecular flow, AdsorptionandChemisorption, Vacuum pumps for HV & UHV regimes: operations & limitations, Vacuum measurements for HV & UHV regimes.

Unit III Stellar Physics (15 Hours)

Kirchoffs laws of radiation, Absorption and emission spectrum with exhibiting line and band type spectra, Black body radiation laws and related special cases. Stellar spectral sequence and effective temperature, stellar spectral classification and relation to HR diagram. Spectral line from a star and concepts of equivalent width, various types of line Sources and Detectors: Techniques of production of UV/visible, microwave, IR radiations, classification of sensors/detectors stellar spectrum formation broadening effects.

Unit IV Spectroscopic Techniques (15 Hours)

Raman Pure rotation, The vibrations or diatomic molecules, The vibrations of diatomic molecules, The vibrations of polyatomic molecules

HMR : The effect of magnetic fields on electrons and nuclei, Nuclear magnetic resonance,

Pulse techniques in NMR, Applications.

Reference Books:

For Unit I

1. Microprocessor Architecture, Progrmmining and Applications- R. Gaonkar, Wily-Eastern Ltd.
2. Microprocessor and Microcontroller- B. Ram, Dhanpati Rai and sons Delhi
3. Advanced Microprocessor and Principles- A.K. Ray, K.M. Bhurchandi Tata Mc Graw Hill Publication Co. Ltd. New Delhi.
4. The 8085 Basics, Progamming and Interfacing- U.V. Kulkarni and T.R. Sontakke, Sadhu Sudha Prakashan, Nanded.
5. Microprocessor and Digital Systems- Dauglas Hall, Tata Mc Graw Hill

For Unit II

1. Materials Science and Engineering An Introduction, William Callister,Jr., (Wiley India)
2. Vacuum Physics and Techniques, Delcher
3. Handbook of Vacuum Science and Technology, Hoffman
4. Vacuum Science and Technology, Rao, Ghosh, K.L.Chopra, Allied Publishers Ltd.

For Unit III

1. Modern Astrophysics – B.W. Carroll and D.A. Ostlie, 1996, Addison-Wesley Publishing Co., Inc.
2. The Physical Universe: An Introduction to Astronomy – Frank H. Shu, 1982, University Science Books, Sausalito, California.
3. Fundamental Astronomy – ed. H. Karttunen, P. Kroger, H. Oja et al., 1987, Springer-Verlag, Berlin.
4. The New Cosmos, 4th edition - A. Unsold and B. Baschek, 1991, Springer-Verlag, Berlin.
5. Astrophysics: Stars and Galaxies – K.D. Abhyankar, 1992, Tata McGraw Hill Publishing Co., New Delhi.

For Unit IV

1. Fundamentals of Molecular Spectroscopy by Colin N. Banwell
2. Spectra of Atoms and Molecules by Peter Bernath (Oxford Uni. Press, USA)
3. 4. Spectroscopy Vol. 1, 2 & 3 by Straughan B. P. and Walker M. A.
4. 5.Atoms, Molecules and Lasers by K. P. Rajappan Nair (Narosa Publishing House, Delhi)
5. Atom, Laser and Spectroscopy by S. N. Thakur, D. K. Rai
6. Introduction to Molecular spectroscopy by C. M. Barrow

MPH 105 Project Dissertation (Core 20)

Credits: **04**	***Contact hours*****: 90** *(Two Semesters)*	***Total Marks:*** **100**

Every students admitted to M Phil Physics programme is required to complete one project dissertation of 4 credits (100 marks) under the guidance of the faculty member as allocated to him by the School at the time of his admission. He will submit three copies of his dissertation work to the Board of Examination and Evaluation (BEE) through the School, which will then be evaluated from an external examiner (from other university). The external examiner will send report of the dissertation adjudication along with score out of 100. Based on the evaluation report of the M Phil dissertation by the external exminer the the BEE will request the Director of the School to conduct final Viva-Voce of the candidate. Following to which, the School Director will fix M Phil Viva-Voce examination of the concerned candidate. Examiners for this Viva-Voce examination with be comprised of the Director (chairman), guide and at least two faculty members from the School. Based on the performance, this examination panel will assess the performance of the candidate and each examiner will assign marks out of 100. Average of the marks allocated by all the members will be sent to the BEE with a recommendation for the award of M. Phil in Physics.

MPH 105 Viva Voce

Credits: **04**		*Total Marks:* **100**

Based on the evaluation report of the M Phil dissertation by the external exminer the BEE will request the Director of the School to conduct final Viva-Voce of the candidate. Following to which, the School Director will fix M Phil Viva-Voce examination of the concerned candidate. Examiners for this Viva-Voce examination with be comprised of the Director (chairman), guide and at least two faculty members from the School. Based on the performance, this examination panel will assess the performance of the candidate and each examiner will assign marks out of 100. Average of the marks allocated by all the members will be sent to the BEE with a recommendation for the award of M. Phil in Physics.

Question Paper Pattern
M. Phil Physics

Time: 03 Hrs **Total Marks: 75**

Note: 1. There shall be a total of 08 (eight) questions each of 15 marks.
2. Students are required to attempt any FIVE of them.
3. Total marks will be 75

Question 1 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit I) **15 Marks**

Question 2 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit II) **15 Marks**

Question 3 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit III) **15 Marks**

Question 4 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit IV) **15 Marks**

Question 5 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit I) **15 Marks**

Question 6 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit II) **15 Marks**

Question 7 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit III) **15 Marks**

Question 8 – Single long answer type question of 15 marks or two sub-questions (of 8 and 7 marks) (On Unit IV) **15 Marks**

(***Dr. M. K. Patil***)
Chairman, BOS in Physics