I. That in the Regulations relating to M.Sc. Physics Degree Course under the Scheme of Examinations and Elective papers be modified to read as follows:

### FIRST SEMESTER

<table>
<thead>
<tr>
<th>S. NO</th>
<th>COURSE COMPONENTS</th>
<th>NAME OF COURSE</th>
<th>SEMESTER</th>
<th>INST. HOURS</th>
<th>CREDITS</th>
<th>HRS</th>
<th>CIA</th>
<th>EXTERNAL</th>
<th>MAX MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>CORE</td>
<td>PAPER 4 – INTEGRATED CIRCUITS AND MICROPROCESSOR 8085</td>
<td>I</td>
<td>6 HRS</td>
<td>3</td>
<td>3</td>
<td>25</td>
<td>75</td>
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</tr>
</tbody>
</table>

Each Elective paper will carry three (3) credits instead of 4

Following elective paper be added in the existing elective list.

Elective – I Paper 9

Any one-out of the following:

3. COMMUNICATION ELECTRONICS
4. ENERGY PHYSICS
5. ASTROPHYSICS

Elective II & III – Papers 18 & 19

Any two – out of the following:

4. MICROPROCESSOR 8086 AND MICROCONTROLLER 8051
5. CRYSTAL GROWTH
6. QUANTUM FIELD THEORY

II. The above amendment to the Regulations to take effect from the academic year 2013-14 onwards.

A.C.S.’13
APPENDIX-12(S)
UNIVERSITY OF MADRAS

M.Sc. DEGREE COURSE IN PHYSICS
CHOICE SYSTEM BASED CREDIT
REVISED SYLLABUS
(w.e.f.2013-14)

PAPER – 4 : INTEGRATED CIRCUITS AND MICROPROCESSOR 8085

UNIT – I  Linear ICs and Applications
Generation of square, triangular and sine waves – pulse generation – Schmitt trigger – Active filters (Second order Butterworth design).
Timer 555 : Internal architecture and working – Schmitt trigger – Astable and monostable multivibrators – Phase Locked Loop.

UNIT – II  Data Counters
Binary weighted and R/2R ladder DAC – Accuracy and resolution – Dual slope DAC- ADC – Simultaneous conversion – Counter method – Successive approximation.

UNIT – III  Combinational and Sequential Logic Circuits
4-bit binary adder and subtracter- Encoder and Decoder – Multiplexer and Demultiplexer.

UNIT – IV  8085 Programming, Peripheral Devices and their Interfacing

UNIT – V  8085 Interfacing Applications
Seven segment display interface – Interfacing of Digital to Analog converter and Analog to Digital converter – Stepper motor interface – Measurement of electrical quantities (voltage and current) – Measurement of physical quantities (temperature and strain).
BOOKS FOR STUDY:

4. Malvino and Leech, *Digital Electronics*

BOOKS FOR REFERENCE:


PRACTICALS

**Paper 5 : PRACTICAL – I (CORE COURSE, FIRST YEAR FIRST SEMESTER) – 4 CREDITS**

**Part – IA : Electronics and Microprocessor 8085** (Any TEN Experiments)

1. FET CS amplifier – Design, Frequency response, input impedance, output impedance
2. Study of attenuation characteristics of Wien’s bridge network and design of Wien’s bridge oscillator using Op-Amp.
3. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp.
4. Design of a Schmitt trigger circuit using IC 741 f or a given hysteresis – application of squarer.
5. Design of a square wave oscillator using IC 741 – Triangular wave oscillator.
6. Construction of pulse generator using the IC 741 – application as frequency divider.
7. OP-Amp. – 4 bit Digital to Analog converter [R / 2R ladder network].
10. Arithmatic operations using IC 7483 – 4 bit binary addition and subtraction.
11. IC 7490 as a scalar and display using IC 7447.
Microprocessor 8085

12. 8-bit addition and subtraction, multiplication and division.
13. Sum of a set of N data (8-bit numbers), Picking up the smallest and largest number in an array. Sorting in ascending and descending order.
14. Code conversion (8-bit numbers): (a) Binary to BCD and (b) BCD to Binary.
15. Addition of multibyte numbers, Factorial.

Part – 1B : General  (Any FIVE Experiments)
1. Cornu’s Method – Young’s modulus and Poisson’s ratio by Elliptic fringes.
2. Stefan’s constant.
5. Thickness of the enamel coating on a wire – by diffraction.
7. Permittivity of a liquid using an RFO.
8. L-G plate.
10. Arc spectrum : Copper.

Paper 8 : PRACTICAL – II  (CORE COURSE, FIRST YEAR SECOND SEMESTER)  
– 4 CREDITS

Part – 2A : Electronics and Microprocessor 8085  (Any TEN Experiments)

1. Design of UJT relaxation oscillator for a frequency – Generation of positive and negative triggering pulses.
3. Op-Amp. – Active filters : Low pass, High pass and Band pass filters (Second Order).
4. Construction of square wave generator using IC 555 – study of VCO.
5. Design of Schmitt trigger circuit using IC 555 for a given hysteresis – Application as squarer.
6. Construction of pulse generator using the IC 555 – Application as frequency divider.
7. IC 7476 / IC 7473 – Study of binary up / down counters
8. IC 7476 – Shift register, ring counter and Johnson counter (twisted ring counter).

Microprocessor 8085

9. Clock program – 12 / 24 hours.
10. LED interface – single LED on / off, binary, BCD, ring and Johnson counters.
11. Interfacing of seven segment display.
13. DAC 0800 interface and wave form generation.
Part – 2B : General  (Any FIVE Experiments)
1. Cornu’s Method – Young’s modulus and Poisson’s ratio by Hyperbolic fringes.
2. Determination of strain hardening coefficient.
4. F. P. Etalon using spectrometer.
5. Solar constant.
8. Edser and Butler fringes – Thickness of air film.
10. Specific charge of an electron – Thomson’s method.

Note :  Practical Examination 1 – Questions from both Part 1A and Part 2A

Practical Examination 2 – Questions from both Part 1B and Part 2B

Paper 14 : PRACTICAL – III
(CORE COURSE, SECOND YEAR THIRD SEMESTER) – 4 CREDITS

Part – 3A : Advanced Microprocessor 8085 and Computational Methods
(Any TEN Experiments)

Advanced Microprocessor 8085
1. ADC 0809 interface.
2. Interfacing of DC stepper motor – Clockwise, Anti-clockwise, Angular movement and Wiper action.
3. Interfacing of Temperature Controller and Measurement
4. Water level detector

Computational Methods
5. Lagrange interpolation with Algorithm, Flow chart, FORTRAN / C PROGRAM, and output.
9. Numerical integration by the trapezoidal rule with Algorithm, Flow chart, FORTRAN / C PROGRAM, and output.

Part – 3B : General  (Any FIVE Experiments)
1. GM counter – Characteristics, inverse square law, absorption coefficient.
2. GM counter – Feather’s analysis : Range of Beta rays.
3. Hall effect.
4. Susceptibility by Quincke’s method.
5. B-H curve using CRO.
6. Thermal diffusivity of brass.
7. Thermal relaxation of bulb.
8. Conductivity measurement using four probe method.
10. Experiments on optical fibres.
11. FFT and DFT of certain signals.

Paper 17 : PRACTICAL – IV  
(CORE COURSE, SECOND YEAR FOURTH SEMESTER) – 4 CREDITS

Part – 4A : Microprocessor 8086 (MASM) and Microcontroller 8051  
(Any TEN Experiments)

Microprocessor 8086 Programs using MASM
1. Addition, Subtraction, Multiplication and Division (8 bit numbers)
2. Multibyte addition and subtraction (64 and 128 bit numbers)
3. Square and square root of 8 bit number
4. Sum of a set of N data (8 – bit numbers), average of N numbers.
5. Sorting in ascending and descending order. Picking up the smallest and largest number in an array.

Micro controller 8051
7. Addition, subtraction, multiplication and division of two 8-bit numbers.
8. Sum of a series of 8-bit numbers, average of N numbers.
10. Sorting in ascending and descending order – Picking up smallest and largest number.
11. LED interface – Binary up/down counter, BCD up/down counter, Ring and twisted ring counter.
12. Interfacing seven segment display.
13. DAC 0800 / 1408 interface and wave form generation.
14. ADC interfacing.
15. Stepper motor interfacing.

Part – 4B : General  (Any FIVE Experiments)
3. Susceptibility by Guoy’s method.
4. Ultrasonics – Compressibility of a liquid.
5. Miscibility measurements using ultrasonic diffraction method.
6. Dielectric measurements in Microwave test bench.
7. Iodine absorption spectra
8. Molecular spectra – AlO band
9. Molecular spectra – CN bands

Note :  Practical Examination 3 – Questions from both Part 3A and Part 4A

Practical Examination 4 – Questions from both Part 3B and Part 4B

ELECTIVE – I  Paper – 9

3. COMMUNICATION ELECTRONICS

UNIT – 1  Antennas and Wave Propagation


UNIT – II  Microwaves

UNIT – III  
**Radar and Television**


UNIT IV  
**Optical Fibres**


UNIT V  
**Satellite Communication**


**BOOKS FOR STUDY and REFERENCE:**


**4. ENERGY PHYSICS**

UNIT – I  

UNIT – II


UNIT – III


UNIT – IV


UNIT – V


BOOKS FOR REFERENCE:

2. Energy Technology by S. Rao and Dr. Parulekar.
4. M.P. Agarwal, Solar energy, S. Chand and Co.,
5. ASTrophysics

Unit-I Observational Astronomy

The electromagnetic spectrum; geometrical optics (ray diagrams, focal length, magnification etc); diffraction (resolving power, Airy disc, diffraction limit etc); telescopes (reflecting, refracting, multi-wavelength).

Unit-II Properties of stars

Brightnesses (luminosities, fluxes and magnitudes); colours (blackbody radiation, the Planck, Stefan-Boltzmann and Wien laws, effective temperature, interstellar reddening); spectral types; spectral lines (Bohr model, Lyman & Balmer series etc, Doppler effect); Hertzsprung-Russell diagram; the main sequence (stellar masses, binary systems, Kepler's laws, mass-luminosity relations); distances to stars (parallax, standard candles, P-L relationships, m-s fitting etc); positions of stars (celestial sphere, coordinate systems, proper motions, sidereal and universal time).

Unit-III The life and death of stars

Energy source (nuclear fusion, p-p chain, triple-alpha, CNO cycle, lifetime of the Sun); solar neutrinos; basic stellar structure (hydrostatic equilibrium, equation of state); evolution beyond the main sequence; formation of the heavy elements; supernovae; stellar remnants (white dwarfs, neutron stars, black holes, degeneracy pressure, Swarszchild radius, escape velocities).

Unit-IV Galaxies

 Constituents of galaxies; stellar populations; the interstellar medium; HII regions; 21cm line; spirals and ellipticals; galactic dynamics; galaxy rotation curves and dark matter; active galaxies and quasars.

Unit-V Cosmology

Galaxies and the expanding Universe; Hubble's Law; the age of the Universe; the Big Bang; cosmic microwave background (blackbody radiation); big bang nucleosynthesis (cosmic abundances, binding energies, matter & radiation); introductory cosmology (the cosmological principle, homogeneity and isotropy, Olber's paradox); cosmological models (critical density, geometry of space, the fate of the Universe); dark energy and the accelerating Universe.

Recommended texts:

Any two out of the following:

4. MICROPROCESSOR 8086 AND MICROCONTROLLER 8051

UNIT - I 8086 Architecture and Programming


UNIT - II 8051 Microcontroller Hardware


UNIT - III 8051 Instruction Set And Assembly Language Programming

Addressing modes – Data moving (Data transfer) instructions : Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions – Logical instructions : byte and bit level logical operations, Rotate and swap operations – Arithmetic instructions : Flags, Incrementing and decrementing, Addition, Subtraction, Multiplication and division, Decimal arithmetic – Jump and CALL instructions : Jump and Call program range, Jump, CALL and subroutines – Programming.

UNIT - III Interrupt Programming


UNIT - IV Interfacing To External World

BOOKS FOR STUDY

1. A. P. Godse and D. A. Godse, “Microprocessors & its Applications”, Technical Publications, Pune,

BOOKS FOR REFERENCE

1. Douglas V. Hall : - Microprocessors and Interfacing programming and Hardware (Tata Mc Graw Hill) (Unit 1)

5.CRYSTAL GROWTH

UNIT – I NUCLEATION (12 Hours)


UNIT – II CRYSTAL GROWTH THEORIES (12 Hours)

Surface energy theory – Diffusion theory – Adsorption layer theory – Volmer theory – Bravais theory – Kossel theory – Two dimensional nucleation theory – Free energy of formation of a two dimensional nucleus – Possible shapes – Rate of nucleation

UNIT – III CRYSTAL GROWTH FROM SOLUTION (12 Hours)


UNIT – IV MELT GROWTH AND VAPOUR GROWTH (12 Hours)
Physical vapour deposition – Chemical vapour deposition – Open and closed systems – Physical and thermo-chemical factors affecting growth process.

UNIT – V GEL GROWTH AND FLUX GROWTH (12 Hours)

BOOKS FOR STUDY
1. M. Ohora and R. C. Reid, “Modeling of Crystal Growth Rates from Solution”
2. J. C. Brice, “Crystal Growth Processes”

BOOK FOR REFERENCE

6. QUANTUM FIELD THEORY

Unit-I Symmetry Principles
Relativistic kinematics, relativistic waves, Klein-Gordon (KG) equation as a relativistic wave equation, treatment of the KG equation as a classical wave equation: its Lagrangian and Hamiltonian, Noether's theorem and derivation of energy-momentum and angular momentum tensors as consequence of Poincaré symmetry, internal symmetry and the associated conserved current.
Unit-II  Quantization of Klein-Gordan Field

Canonical quantization of the KG field, solution of KG theory in Schrödinger and Heisenberg pictures, expansion in terms of creation and annihilation operators, definition of the vacuum and N-particle eigenstates of the Hamiltonian, vacuum expectation values, propagators, spin and statistics of the KG quantum.

Unit-III  Quantization of Dirac Field

Review of Dirac equation and its quantization, use of anti-commutators, creation and destruction operators of particles and antiparticles, Dirac propagator, energy, momentum and angular momentum, spin and statistics of Dirac quanta.

Unit-VI  Quantization of Electromagnetic Fields

Review of free Maxwell's equations, Lagrangian, gauge transformation and gauge fixing, Hamiltonian, quantization in terms of transverse delta functions, expansion in terms of creation operators, spin, statistics and propagator of the photon.

Unit-V  Perturbative Interaction at Tree Level

Introduction to interacting quantum fields, Wick's Theorem, Feynman Diagram, Examples from quantum electrodynamics at the tree level: positron-electron and electron-electron scattering.

References:

1. C. Itzykson and J.B. Zuber, *Quantum Field Theory*.
2. J.D. Bjorken and S.D. Drell, *Relativistic Quantum Fields*.
3. L. Ryder, *Quantum Field Theory*.
5. M.E. Peskin and D.V. Schroeder, *An Introduction to Quantum Field Theory*.

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A.C.S.’13