Dr. B. VENKATRAM REDDY
Chairperson, Board of Studies
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL–506 009, T.S

Date: 6th Jan., 2017

As per the decision taken in the meeting of Chairpersons of Board of Studies, Kakatiya University, the CBCS pattern for M.Sc (Physics) II-Semester and the open elective for Non-Science PG IV-Semester have been revised. The details are given below.

II-Semester (for 2016-2017 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam		Total Max. Marks	Total Min. Marks	No. of credits
				Max. Marks	Min. Marks			
		Theory						
2.1	201	Statistical Mechanics	20	80	32	100	40	04
2.2	202	Quantum Mechanics	20	80	32	100	40	04
2.3	203	Digital principles and Integrated circuits	20	80	32	100	40	04
2.4	204	Computer Programming and Numerical Methods	20	80	32	100	40	04
		Practical						
2.6	105	General Physics – II	--	100	40	100	40	04
2.7	106	Electronics - II	--	100	40	100	40	04
Seminar			--	25	10	25	10	01
Total						**625**		**25**

The question paper pattern for II-Semester is similar to that of Semester-I

IV-Semester (w.e.f. 2016-2017 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam		Total Max. Marks	Total Min. Marks	No. of credits
				Max. Marks	Min. Marks			
		Theory						
4.1	401	Electromagnetic Theory and Optics	20	80	32	100	40	04
4.2	402	Molecular Resonance and Spectroscopy	20	80	32	100	40	04
4.3A	403A	Solid state Physics: (Special – III) **(OR)**						
4.3B	403B	Electronics: (Special -III) Microcontrollers **(OR)**	20	80	32	100	40	04
4.3C	403C	Nanoscience: Special -III Material Science – II						
4.4A	404A	Solid state Physics: (Special –IV) **(OR)**						
4.4B	404B	Electronics:(Special -IV) Optical, Satellite and Mobile Comm. Systems **(OR)**	20	80	32	100	40	04
4.4C	404C	Nanoscience: Special -IV Nanoscience –II						
4.5	405	Open elective*	20	80	32	100	40	04
		Practical						
4.6	406	General Physics – II	--	100	40	100	40	04
4.7A	407A	Solid State Physics (*Special-I*) **(OR)**						
4.7B 4.7C	407B 407C	Electronics (*Special-I*) **(OR)** Nanoscience (*Special-I*)	--	100	40	100	40	04
Seminar			--	25	10	25	10	01
Total						**725**		**29**

* Open elective paper should be chosen by the student from the papers offered by Non-Science P.G courses.

Dr. B. Venkatram Reddy, Chairperson, BoS in Physics, KU, Wgl
(6th Jan., 2017)

Department of Physics, Kakatiya University offers "Renewable Energy Resources" as an open elective under 'Choice Based Credit System (CBCS)' for IV-Semester Non-Science PG courses for the academic year 2016-2017.

1. Open Elective paper carries 100 marks (20 marks for internal assessment examination and 80 marks for Semester end examination) equivalent to 04 credits.

2. The internal assessment question paper of Open Elective paper contains 10 compulsory questions carrying two marks each and Total marks are 20. The duration of internal assessment examination is 90 minutes. Answers should be written in the ascending order of question number only.

3. In open elective paper, the candidate should get a minimum of 40% marks to pass the examination including marks of internal assessment examination with a condition that the candidate should get a minimum of 40% marks in the semester end examination.

   The syllabi of M. Sc (Physics) II-Semester; Syllabus and question paper pattern of Open Elective for IV-Semester Non-Science PG courses are enclosed herewith.

Dr. B. Venkatram Reddy, Chairperson, BoS in Physics, KU, Wgl
(6^{th} Jan., 2017)

S Y L L A B U S

M.Sc. Physics II-Semester Theory

2.1 STATISTICAL MECHANICS

Unit I: Fundamentals of statistical mechanics : Macrostates and Microstates of a system – principle of equal apriori probability –phase space – quantization of phase space –concept of ensemble – ensemble average – density distribution function in phase space – Liouville's theorem – Maxwell – Boltzman (MB), Fermi-Dirac(FD), Bose-Einstein(BE) distributions – classical limit – entropy and probability – entropy of a two level system.

Unit II : Ensembles : Microcanonical ensemble(MCE) – Thermodynamics in MCE- Entropy of an ideal gas in MCE – Gibbs Paradox – Sackur – Tetrode equation – Canonical ensemble(CE) – Thermodynamics in CE – Ideal gas in CE- Maxwell's velocity distribution – Equipartition energy theorem – Grand Canonical Ensembel(GCE) – Thermodynamics in GCE – Ideal gas in GCE – Fermi – Dirac and Bose-Einstein distribution functions from grand canonical partition function.

Unit III : Bose Systems : Equation of state for ideal BE and FD gases – Photons – Planks distribution law – Phonons – Specific heat of solids – Einstein and Debye's theories – Bose Einstein condensation – Liquid He-Two Fluid model – Phonons – Rotons – Superfluidity.

Unit IV: Fermi systems: Ideal Fermi gas – Free electron model – electronic specific heat – thermionic emission – Pauli paramagnetism –Landau diamagnetism- white dwarfs – Boltzman transport equation – Electrical conductivity – Thermal conductivity – Wiedermann – Franz law – Non-equilibrium semiconductors – Electron-hole recombination – Classical Hall effect – Quantum Hall effect. Ising model and its 1-D solution.

Text and reference books:

1. Statistical Mechanics – **Agarwal & Melvin Eisner** (New age international).
2. Statistical Mechanics – **Kerson Huang** (John Wiley & Sons).
3. Statistical Mechanics – **R.K. Srivastava & J.Ashok** (Prentice-Hall of India).
4. Statistical Physics – **L.D. Landau & E.M.Lifshits (Pergamon)**
5. Statistical Mechanics – **D.A. McQuarrie (Harper & Row).**

2.2 QUANTUM MECHANICS-I

Unit-I: Bra and Ket Notation: Principles of superposition. Bra and Ket vectors, linear operators. Hermitian conjugate. Eigen values and Eigen vectors of Hermitian operators. Complete set of states. Complete set of commuting operators. Continuous spectrum of Eigen values. Orthogonality.

Unit-II: Representations: Properties of Dirac – Delta function. Orthogonal basis. Representation for ket, bra and operator. Wave function as a representation of ket, position and momentum representations. Poissons brackets, Quantum conditions. Equation of motion, Schroedinger Heisenberg and interaction pictures. Ehrenfest theorem. Harmonic oscillator problem in terms of creation and annihilation operators.

Unit-III: Exactly solvable problems: Spherically symmetric potentials in 3 dimensions, orbital angular momentum operator. Commutation relations, Eigen vectors and Eigen values of L^2 an L_z. Pauli spin operators. The hydrogen atom problem, Vibrating rotator, rigid rotator and 1D harmonic oscillator.

Unit-IV: Approximate methods:

i) Time independent perturbation theory: Non-degenerate levels. Application to normal He atom and anharmonic oscillator. Degenerate levels-application to first order stark effect in hydrogen atom with n=2 and to normal Zeeman effect.

ii) Time dependent perturbation theory: Transition amplitude in first and second order, first order transition constant perturbation, Fermi golden rule, harmonic perturbation. Emission and absorption probabilities. Einstein A and B Coefficients.

iii) Variation method, application to normal Helium, atom.

Text and reference books:

1. Quantum Mechanics – **Ajoy Ghatak & S.Loknathan** (Macmillan India Ltd.)
2. The principles of Quantum Mechanics – **P.A.M. Dirac** (Oxford University Press).
3. Quantum Mechanics – **L.I. Schiff** (McGraw hill)
4. A Text Book of Quantum mechanics – **P.M. Mathews & K.Venkatesan** (Tata McGraw Hill).

2.3 DIGITAL PRINCIPLES AND INTEGRATED CIRCUITS

Unit- I : Logic gates, positive and negative logic, Boolean laws, logic simplifications using Boolean Algebra and Karnaughmap method.4 bit Binary Adder, Encoders & Decoders, parity generator and checker Multiplexer and DeMultiplexer. RS,D,JK & MS-JK flipflops, their operating principles and truth tables, shift registers and their operations, counters: Asynchronous 4 bit binary counter and with feedback for different modulo – Synchronous counters – Ring counter.

Unit II : Logic families and Memory Devices: Logic families and their performance characteristics – RTL, DTL, I^2R Logic, TTL, ECL, PMOS, NMOS & CMOS logic, Tristate logic (TSL). Semiconductor memories: Diode ROM, EPROM, E^2PROM, Memory organization and expansion – Memory devices: 8155 RAM, 2716 EPROM – 8355 ROM with I/O ports.

Unit III : Operational Amplifiers characteristics and Applications: OP-AMP Basic Structure – Difference amplifier circuits using BJTs only. OP-AMP-dc and ac performance characteristics – open and closed loop configurations, virtual ground concept; Inverting and Non inverting Amplifier – voltage follower – Adder, Subtractor, Differentiator, Integrator & difference amplifier, Analog computation – solution of second order differential equation – Log and antilog amplifiers. Waveforms generators: sinewave, squarewave, traiangular and sawtooth wave voltage comparators.

Unit IV : Active filters & Timer circuits: comparison between passive and active filters, first order low pass, high pass active filters, band pass, band reject and all pass filters. 555 timer – description of functional diagram – Astable and monostable operations, VCO, Schmitt trigger. Phase locked loop (IC565): Basic Principles – frequency multiplication/division, analog phase detector.

Text and reference books:

1. Modern Digital Electronics – **RP Jain** (Tata McGraw Hill 3rd edition)
2. Fundamentals of digital circuits – **A.Anand Kumar** (Prentice-Hall of India)
3. Linear Integrated circuits – **Shail B.Jain & Roy choudhury** (New Age International Publishers 2nd edition)
4. Operational Amplifiers – **Ramakanth A GayKwad** (Prentice-Hall of India)
5. Linear Integrated circuits – **S.Salivahanan & V.S. Bhaaskaran** (Tata McGraw Hill)
6. Microprocessor Architecture, Programming and applications with 8085 – **Ramesh S Goankar** (Wiley Eastern Edition)
7. Digital Principles and Applications – **Malvino & Leach** (Tata McGraw Hill).

2.4 COMPUTER PROGRAMMING AND NUMERICAL METHODS

Unit I : C-I Character set, Identifiers and key words, data types, constant, variables, and arrays, declarations, expressions, statements, symbolic constant, arithmetic operators, Unary operator, relational and logical operators, assignment operators, conditional operator, library functions, getchar, putchar, scanf, printf, gets, puts functions. Control statements – while, do-while, for statements, nested loops, if-else, switch, break, continue statements, comma operator; go to statement.

Unit II : C-II Functions – defining and accessing a function – passing arguments to a function, specifying argument data types, functions prototypes. Storage classes, automatic variables, external variables, static variables, multi file programs. Arrays – defining an array, processing an array passing arrays to functions, multi dimensional arrays, array to a function, pointers – pointer declarations, passing pointers on pointers, pointers and multi dimensional arrays, arrays of pointers, passing functions to other functions, structures and unions – defining a structure, processing a structure, user defined data types, structures and pointers, passing structure to a function, self-referential structures – unions.

Unit III : Numerical Methods – I : Finding the roots of a transcendental equation – Bisection method, Newton – Raphson method – solving of problems - writing programs in C-language for these methods.Rate of convergence – methods for multiple roots. Finding the roots of polynomial equations – Berge viata, Baristow and Graffee root squaring methods - Solving of problems. Writing programs in C-language for these methods.

Unit IV : Numerical Methods – II Solution of simultaneous equations – Cramer's rule, Gauss elimination method, triangularization method. Jacobi, Gauss-siedel and successive over relaxation methods. Problems: Writing of programs in C-language for these methods.

Text and reference books:

1. Numerical Mathematical Analysis – **U.B. Scarborough** (OXFORD & IBH publishing Co. Pvt. Ltd.)
2. Numerical Methods for Scientific and Engineering Computation **– M.K.Jain, S.R.K.Iyengar & R.K.Jain** (New Age International Pvt. Ltd.)
3. Programming with C-**Byron S.Gottfried** (Tata McGraw Hill Edition)
4. Let us C-**Kanitkar** (BPB Publications)
5. Computer Oriented Numerical Methods – **V.Rajaraman** (Prentice – Hall of India Pvt.Ltd.

M.Sc. Physics II-Semester Practical's

2.5 General Physics – I Laboratory

1. Determination of Cauchy's constants for a) glass b) quartz c) calcite.
2. Biprism – Determination of wave-length of monochromatic light (sodium light).
3. Michelson interferometer - Determination of λ
4. Velocity of ultrasonic waves in organic liquids – using Interferometer.
5. Thermal expansion by Fizeau's method (Coefficient of linear expansion of brass).
6. Diffraction due to single slit – Determination of λ
7. Michelson interferometer – Determination of λ
8. Computer Programming – Least square fitting of s straight line.

2.6 Electronics – I Laboratory

1. Operational Amplifiers – Measurement of
   a) Bias current and offset voltage b) CMRR
2. Operational Amplifiers – Measurement of
   a) Slew rate b) output impedance
3. Op-amplifier – study of gain frequency response
   a) Inverting Op-amplifier – study of gain frequency response
   b) Non-inverting op-amplifier – study of gain frequency response.
4. a) Op-amp as differentiator b) Op-amp as Integrator.
5. Phase shift oscillator using IC741.
6. IC555 timer – Monostable multivibrator.
7. IC555 timer – Schmitt trigger.
8. IC555 timer – a) Astable Multivibrator b) Voltage controlled oscillator.
9. Digital experiments: a) Verification of DeMorgans Theorem. b) Construction and verification of half and full adder circuits and c) Universal Building block

Text and reference books:

1. Advanced practical Physics – **Wornsop & Flint.**
2. Advanced Practical Physics vol.1 – **SP Singh** (Pragatiprakashan).
3. A Text Lab manual in Electronics – **ZBAR** (Tata McGraw Hill).
4. Linear Integrated Circuits – **Shail B.Jain & B.Ray Choudhury** (New Age International Publishers, 2nd edition).
5. Linear Integrated Circuits – **Shalivahanan & VS Bhaaskaran** (Tata McGraw Hill, 2008).

Department of Physics
Kakatiya University, Warangal
Open Elective (CBCS)
(For Non-science PG Courses, for 2016-2017 academic year)
Semester - IV
Renewable Energy Resources

Unit I: Principles of Solar Radiation and Collection (Qualitative only): (12 Hrs)

Non-renewable energy resources – Principles of power generation and transmission. A model of conventional thermal power plant. Advantages and disadvantages of conventional power plants. Role and potential of new and renewable sources, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Unit II: Solar Energy Storage and Applications: (10 Hrs)

Solar energy collectors - Flat plate and concentration collectors, classification of concentration collectors and orientation, advanced collectors. Different sensible, latent heat and stratified storage, solar ponds. Solar Applications – solar heating/ cooling technique, solar distillation and drying, photovoltaic energy conversion.

Unit III: Wind and Bio-Mass Energy: (10 Hrs)

Resources and potentials, horizontal and vertical axis windmills, performance characteristics. Principles of Bio-Conversion, Energy from waste, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, LPG and CNG.

Unit IV: Geothermal and Ocean Energy: (08 Hrs)

Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants, land and their economics.

TEXT BOOKS:

1. Non-Conventional Energy Sources - G.D Rai, Khanna Publishers
2. Renewable Energy Resources-Twidell & Wier, CRC Press (Taylor & Francis)

REFERENCE BOOKS:

1. Renewable energy resources - Tiwari and Ghosal, Narosa.
2. Renewable Energy Technologies - Ramesh & Kumar, Narosa
3. Non-Conventional Energy Systems - K Mittal, Wheeler
4. Renewable energy sources and emerging technologies by D.P. Kothari, K.C. Singhal.

Faculty of Science
MA/M.Com (IV - Semester)
Open Elective (CBCS)
(For Non-science PG Courses, for 2016-2017 academic year)

Renewable Energy Resources

Time: 3 Hrs **Max. Marks: 80**

Answer all questions. All questions carry equal marks (5 x 16 = 80)

1. **(a) Question from Unit – I**
   (b) Question from Unit – II
   (c) Question from Unit – III
   (d) Question from Unit – IV

2. **(a) Question from Unit – I**

   OR

   (b) Question from Unit – I

3. **(a) Question from Unit – II**

   OR

   (b) Question from Unit – II

4. **(a) Question from Unit – III**

   OR

   (b) Question from Unit – III

5. **(a) Question from Unit – IV**

   OR

   (b) Question from Unit – IV