K LEF

(Deemed to be University estd. U/S 3 of the UGC Act, 1956)

DEPARTMENTOF PHYSICS

4th Board of Studies Meeting

19th May 2021

Dr. G. SUNITA SUNDARI
Head of the Department
Department of Physics
Koneru Lakshmaiah Education Foundation
(Deemed to be University)
Green Fields, Vaddeswaram-522 302.
Guntur Dist., A.P., India.

XXXIII Academic Council - Annexure 2.7

Department of Physics

Minutes of 4th Board of Studies Meeting

The Department held its 4th BOS meeting on **19th May 2021, 2021 from 10:00 am to 01:00 pm**

The following members attended the meeting:

1. Dr. G. Sunita Sundari, Head of the Dept. and Associate Professor, BOS-Chairperson
2. Dr.M.Venkateswartlu, Asst. Professor
3. Prof. J. Suryanarayana Murty, Professor, Dept. of Physics, IIT Hyderabad
4. Prof. K. S. Ramesh, Professor, Dept. of ECE, KLEF
5. Dr. G. China Satyanarayana, Assoc. Professor, Dept. of ECE, KLEF
6. Dr.N.S.M.P. Latha Devi, Associate Professor
7. Dr. K.Swapna, Associate Professor
8. Dr.Sk. Mahamuda, Associate Professor
9. Dr. M V V K Srinivas Prasad, Asst. Professor
10. Dr. A.Venkateswara Rao, Asst. Professor
11. Sk.Babu, Asst. Professor
12. Dr. S. Shanmugan, Asst. Professor
13. Mr M Gnana Kiran, Asst. Professor
14. Prof. B.V. Appa rao, Professor, HOD, Dept. of Mathematics
15. Prof. J.V. Shanmukha Kumar, Professor, HOD, Dept. of Chemistry

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Agenda Items

Item No.	Item Description
1	Follow-up actions on the Minutes of the previous meetings of the 3rd Board of Studies of Department of Physics, KLEF
2	To revise the Y20 syllabus of M.Sc -Y20 courses based on feedback received from stake holders for the A.Y: 2021-22
3	To include two research-oriented courses for the existing Pre-PhD Physics curriculum
4	To remove the Seminar-2 course (19PH5208) from the MSc Physics curriculum

AGENDA and RESOLUTIONS

Agenda Item 1

To consider and approve the previous 3rd BoS meeting minutes held on 28th Sept. 2020.

AGENDA ITEM-2

To revise the syllabus of Y20 curriculum in MSc Physics (Analog Electronics (19PH5104); Nuclear Physics (19PH5303); Particle Physics (19PH5304)), To increase the course conducting hours of Digital electronics lab (19PH5207)	**Recommended and sent for the approval of Academic Council**

Discussion:

Based on the feedback received from the Dr.K.Swapna, course coordinator of Analog Electronics (19PH5104) and Digital Electronics to modify the syllabus and few experiments in digital electronics lab and also feedback received from Dr. S. Shanmugan, course coordinator of Nuclear Physics (19PH5303); Particle Physics (19PH5304) to modify the existing syllabus. The guidelines received from the committee members, to enhance the career prospects of the students, the DAC members discussed revising the syllabus of Y19 curriculum in MSc Physics.

Resolution:

As per the guidelines received from the committee members and the feedback received from the course coordinators and in view of enhancing the career prospects of the students, the DAC members discussed revising the syllabus of Y19 curriculum in MSc Physics (Analog Electronics (19PH5104); Nuclear Physics (19PH5303); Particle Physics (19PH5304)) and implement the same from the Y21 admitted batch students.

The same is accepted and recommended by the BOS chairman and other committee members with the following revised course codes. Considering the suggestions and recommendations given by

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the internal committee members and course coordinators (CCs), we are increasing the credit and contact hours for the existing course Digital Electronics Lab (19PH5207) without any revision of course content.

All the committee members attended in the DAC meeting approved the modified total number of credits, and hence, the same is recommended to the Academic Council for approval **and given in Annexure-1.**

Analog Electronics – 21PH5104
Nuclear Physics – 21PH5303
Particle Physics – 21PH5304
Digital Electronics Lab -21PH5207

AGENDA ITEM-3

To include two research-oriented courses for the existing Pre-PhD Physics curriculum.	Approved and recommend to the Academic Council for approval

Discussion: The New faculty Dr. S. Shanmugan joined in year 2020, and he requested to include the few Pre-Ph.D courses related Solar cells. The syllabus for those courses were discussed in BoS.
Resolutions: As per the guidelines received from the committee members and faculty, we have introduced new research-oriented courses for the existing Pre-PhD Physics curriculum. The same is accepted and recommended by the BOS chairman and other committee members with the following course codes. **(Annexure-2)**

Physics of Solar Cells – 21PHY206
Advanced Solar Energy Storage Technologies – 21PHY309

AGENDA ITEM-4

To remove the Seminar-2 course (19PH5208) from the MSc Physics curriculum	Approved and recommend to the Academic Council for approval

Resolutions: With reference to the feedback given by students and alumni, the seminar-2 (19PH5208) is removed from the curriculum. In addition to that we have moved the seminar-1 course and presented as a single course in second semester of first year. The same is accepted and recommended by the BOS chairman and other committee members with the following revised course code. Seminar – 21PH5208 and also resolved and approved in the BOS meeting the inclusion of PDD file prepared for the Y21 batch students. The same has been recommended to the Academic council for the necessary approval.

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MEMBERS ATTENDED THE BOARD OF STUDIES MEETING, DEPARTMENT OF PHYSICS

S. No.	Name	Designation	Position	Signature
1	Dr. Raghuveer	Professor	BOS Patron	ABSENT
2	Dr. G. Sunita Sundari	Associate Professor	BOS-Chairperson	
3	Dr. M. Venkateswarlu	Asst. Professor	BOS-Secretary	
4	Prof. J. Suryanarayana Murty	Asso. Professor,Dept. of Physics, IIT Hyderabad, Telangana. Mobile No. 9676212499 Office: 040-23017085 E –mail: surya@iith.ac.in	External Member& Expert	ABSENT
5	Dr. V.N. Mani	Scientist-E, C-MET, Telangana, Mobile No. 07382489862 E-mail: vnmanicrystal1272001@gmail.com	External Member & Expert	ABSENT
6	Dr. N. S. M. P. Latha Devi	Associate Professor, Dept. of Physics	Internal Member	
7	Dr. Sk. Mahamuda	Associate Professor	Internal Member	
8	Dr. M V V K Srinivas Prasad	Assistant Professor	Internal Member	
9	Dr. N. Krishna Jyothi	Assistant Professor	Internal Member	
10	Dr A Venkateswara Rao	Assistant Professor	Internal Member	
11	Dr Sk Babu	Assistant Professor	Internal Member	
12	Dr S. Shanmugham	Assistant Professor	Internal Member	
13	Mr M Gnana Kiran	Assistant Professor	Internal Member	
14	Dr. B. V. Appa Rao	Professor, HOD, Dept. of Mathematics	Internal Member	

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Annexure-1

Course Code	Course Name	Existing Syllabus	New Syllabus	Topics Added/ Removed/ Replaced	Justification for the Modification	
21PH5104	Analog Electronics	**Circuit Theorems and Special Diodes:** Kirchoff's laws for current and voltage – Thevenin's and Norton's theorems and superposition theorems with examples – p-n junction diodes – Zener diode – tunnel diode – Schottky barrier diode – varactor diode-photodiode – solar cell – photodiodes and transistors – light emitting diode – semiconductor laser – UJT – opto-couplers. **Bipolar Transistor Amplifiers and FETs:** Biasing characteristics of junction transistors – analysis using re model-fixed bias-voltage divider bias-emitter bias – direct coupled transistor amplifiers – single stage transistor amplifier – frequency response – feed back in amplifiers – effect of negative feedback in amplifiers – FETs – different types-low and high frequency FETs, frequency response of FET – applications **Oscillators:**	**Special Diodes and Transistor Amplifiers:** Diode applications: Tunnel diode – Schottky barrier diode – varactor diode-photodiode – solar cell – light emitting diode – semiconductor laser – UJT – opto-couplers. BJTs: Biasing, types of biasing, h-parameters, equivalent representation of a transistor using h – parameter model, self-bias design, amplifier design from biasing, amplifier analysis using h-parameters (Gain, Bandwidth, input and output impedances), Design of a CE amplifier. Common drain and gate amplifier. FETs – common drain and common gate characteristics. **Negative feedback amplifiers:** Need for negative feedback, feedback characteristics, 4 topologies (quantitative analysis only), comparison of the input and output impedances of all the four topologies. Power amplifiers: concept of power amplifiers, class A class B and class AB, class C and class D power amplifiers. **Operational Amplifiers:**	**Removed** Kirchoff's laws for current and voltage – Thevenin's and Norton's theorems and superposition theorems with examples – p-n junction diodes – Zener diode – tunnel diode – Schottky barrier diode – varactor diode-photodiode – solar cell – photodiodes and transistors – light emitting diode – semiconductor laser – UJT – opto-couplers. Op-amp with negative feedback-voltage series feedback – effect of feedback on closed	**Based on the stakeholders feedback**	**20**

		Low frequency and high frequency amplifiers – power amplifiers – oscillator principle – oscillator types – frequency stability response – phase shift oscillator – Wein bridge oscillator – LC tunable oscillators – multivibrators – monostable and astable – sine wave and triangle wave generation – clamping and clipping – crystal oscillators and their applications. **Operational Amplifiers:** Block diagram of a typical Op-Amp-DC and AC analysis of dual input and balanced output differential amplifier. Open loop configuration inverting and noninverting amplifiers. Op-amp with negative feedback- voltage series feedback – effect of feedback on closed loop gain input resistance, output resistance, bandwidth and output offset voltage- voltage follower. **Practical Op-amps:** Input offset voltage, input bias current, input offset current, total output offset voltage, CMRR frequency response. Summing amplifier, scaling and averaging amplifiers, integrator and differentiator, instrumentation amplifier. Oscillators principles ,oscillator types , frequency stability, response , The phase	Basics: Ideal OPAMP, OPAMP characteristics, ideal and practical OPAMP, CMRR, slew rate, Virtual Ground, inverting and non-inverting amplifiers. Applications of OPAMPs: Adders, subtractors, scaling amplifier (using LM324 – Quad OPAMP),Integrator; Differentiator, comparator using 710 IC, Schmitt trigger, Instrumentation amplifier, Oscillators, Multivibrators. **Active Filters:** Design of LP, HP, BP, BS filters (Butterworth filter, first order and 2nd order). **Textbooks:** 1) Microelectronic Circuits: Analysis and Design 2nd Edition – Muhammad H. Rashid. 2) Electronic Devices and Circuit Theory 12th Edition – Robert L. Boylestad. 3) Electronic Devices and Circuits 5th Edition – David A. Bell. 4) Linear IC Applications – RamakanthGaykwad. **Reference Books :** 1. J.Milman and C.C. Halkias, Electronic Devices and Circuits, McGraw-Hill (1981). 2. A.P. Malvino, Electronics:Principles and	loop gain input resistance, output resistance, bandwidth and output offset voltage-voltage follower. Oscillators principles ,oscillator types , frequency stability, response , The phase shift oscillator, Wein bridge oscillator, Multivibrators- Monostable and astable, comparators – square wave and triangular wave generators. **Added Topics** h-parameters Design of a CE amplifier. Common drain and gate amplifier topologies (quantitative analysis only), comparison of the input and output impedances of all the		

		shift oscillator, Wein bridge oscillator, Multivibrators- Monostable and astable, comparators – square wave and triangular wave generators. **Text Books:** 1. R.L. Boylsted and L.Nashelsky, Electronic Device and Circuits, Pearson Education (2003). 2. J.Milman and C.C. Halkias, Electronic Devices and Circuits, McGraw-Hill (1981). 3. A.P. Malvino, Electronics:Principles and Applications, Tata McGraw-Hill (1991). Op-Amps & Linear integrated circuits, RAMAKANTH A.GAYAKWAD (PHI), 2002, 4th Edition	Applications, Tata McGraw-Hill (1991). 3. V.K. Mehta, Rohit Mehta, Principles of Electronics,(LPSPE), 12th Edition(2020).	four topologies. Power amplifiers: concept of power amplifiers, class A class B and class AB, class C and class D power amplifiers (using LM324 – Quad OPAMP),Integrator, Differentiator, comparator using 710 IC, Schmitt trigger, **Active Filters:** Design of LP, HP, BP, BS filters (Butterworth filter, first order and 2nd order).		
21PH5303	Nuclear Physics	**Two body problem and Nuclear Forces** The Deuteron – Ground state of deuteron – Magnetic dipole moment of deuteron – Properties of nuclear forces –Scattering cross section – High energy nucleon-nucleon scattering –Spin dependence – Charge	**Two body problem and Nuclear Forces** Ground state of deuteron – Magnetic dipole moment of deuteron – Properties of nuclear forces –Scattering cross section – High energy nucleon-nucleon scattering – Charge symmetry – Repulsion at short distances – Meson theory of nuclear forces – Exchange forces.	**Removed Topics** Charge independence Internal conversion. Isospin – Reaction cross section – Compound nucleus reactions – Breit -	**Based on the stake holders and BOS external members feedback**	**20**

		symmetry – Charge independence – Repulsion at short distances –Meson theory of nuclear forces – Exchange forces. **Nuclear Models** The degenerate gas model – Liquid drop model –Binding energy of nucleus – semi empirical mass formula (Bethe-Weizsacker formula) – Stability of nuclei against beta decay –Mass parabola – Fermi gas model – Alpha particle model – Shell model – Collective model – Optical model. **Radioactive Decays** (Alpha, Beta, Gamma radiations): Law of radioactive decay– Half life, mean life and successive radioactive transformation – Alpha decay and barrier penetration – Gamow's theory of alpha decay – Pauli's hypothesis and Fermi theory of beta decay – selection rules – Electron captures – Absorption of Gamma rays by matter – Interaction of Gamma ray with matter – Internal conversion. **Nuclear Reaction, Fission and Fusion** **I:** Types of reaction and conservation laws – Energetic of nuclear reactions – Isospin – Reaction cross section –	**Nuclear Models** The degenerate gas model – Liquid drop model –Binding energy of nucleus – semi empirical mass formula (Bethe- Weizsacker formula) – Stability of nuclei against beta decay –Mass parabola – Fermi gas model – Alpha particle model –Optical model. **Radioactive Decays** (Alpha, Beta, Gamma radiations): Law of radioactive decay– Half life, mean life and successive radioactive transformation – Alpha-decay and barrier penetration – Gamow's theory of alpha decay – Pauli's hypothesis and Fermi theory of beta decay – selection rules – Electron captures – Absorption of Gamma rays by matter. **Nuclear Reaction, Fission and Fusion** **I:**Introduction:-Types of Nuclear Energy, Flux and Fluence, Neutron Cross Section, Reactor Flux Spectrum – conservation laws – Energetic of nuclear reactions. **II:** Characteristics of fissions – Energy in fission – Fission reactors – Characteristics of fusion – Solar fusion – Controlled fusion reactors. **Prescribed Text Books:** 1. Introductory Nuclear Physics – Kenneth S Krane.	Wigner one level formula **Added Topics** Types of Nuclear Energy, Flux and Fluence, Neutron Cross Section, Reactor Flux Spectrum		

		Compound nucleus reactions – Breit - Wigner one level formula.**II:** Characteristics of fissions – Energy in fission – Fission reactors – Basic fusion processes –Characteristics of fusion – Solar fusion – Controlled fusion reactors. **Prescribed Text Books:** 1. Introductory Nuclear Physics – Kenneth S Krane. 2. Nuclear Radiation Detectors – S.S. Kapoor & V.S. Ramamurthy 3. Radiation Detection and Measurement – G.F. Knoll **Reference Books:** 1. The Atomic Nucleus – R.D. Evans. 2. Nuclear and Particle Physics – E.B.Paul. Techniques for Nuclear and Particle Physics experiments – William. R. Leo-	2. Nuclear Radiation Detectors – S.S. Kapoor & V.S. Ramamurthy 3. Radiation Detection and Measurement – G.F. Knoll **Reference Books:** 1. The Atomic Nucleus – R.D. Evans. 2. Nuclear and Particle Physics – E.B.Paul. Techniques for Nuclear and Particle Physics experiments – William. R. Leo.			
21PH5304	Particle Physics	Broad classification of elementary particles and particle interactions in nature, Properties of the Elementary Particles , Properties of the Fundamental Interactions conservation laws, symmetry classifications of elementary particles- Gell-Mann-Nishijima scheme, CPT conservation, Quark hypothesis & Quantum chromodynamics, Quark	**Introduction Particle Physics:** Kinematics of Nuclear – Elementary Particle Reactions – Scattering and Form Factors – Broad classification of elementary particles – particle interactions in nature – Feynman Diagrams **Invariance Principles and Conservation Laws:**	**Topics Added** **Introduction Particle Physics:** Kinematics of Nuclear – Elementary Particle Reactions –	**Based on the stake holders and BOS external members feedback**	**20**

		model and quark composition of mesons and baryons – Color and Flavor – Weak and Strong interactions – Standard model, Particle accelerators and detectors: linear accelerators, cyclotron, synchrotron, colliding beam accelerators (LHC), gas-filled counters, scintillation detectors, semiconductor detectors. **Text Books:** 1. The Atomic Nucleus – R.D. Evans. 2. Nuclear and Particle Physics – E.B.Paul. 3. Techniques for Nuclear and Particle Physics experiments – William. R. Leo	Elementary Particles (quarks, baryons, mesons, leptons) – Classification: spin and parity assignments – isospin – strangeness – Elementary ideas of SU(2) & SU(3) – Gell-Mann-Nishijima scheme of C, P and T invariance – Properties of quarks. **Particle accelerators and detectors**: Electroweak interaction-W & Z Bosons. Parity non-conservation in weak interactions, Quark hypothesis, Quark model and quark composition of mesons and baryons – Colour and Flavour – Weak and Strong interactions – Standard model, linear accelerators, cyclotron, synchrotron. **Applications of particle physics Fusion reactors:** Mossbauer Spectroscopy – Applications in medicine: Basics of heavy ion therapy for cancer treatments – scintillation detectors – semiconductor detectors. Atmospheric, solar and Supernova neutrinos. Solar neutrino problem. **Text Books:** 1. Introduction to Nuclear and Particle Physics by Ashok Das and Thomas Ferbel (World Scientific). 2. Introduction to High Energy Physics – D.H.Perkins, Addison Wesley, Reading, Mass (1982) 3. The ideas of Particle Physics:An	Scattering and Form Factors – **Invariance Principles and Conservation Laws:** (quarks, baryons, mesons, leptons) – Classification: spin and parity assignments – isospin – strangeness – Elementary ideas of SU(2) & SU(3) – Gell-Mann-Nishijima scheme of C, P and T invariance – **Particle accelerators and detectors**: Electroweak interaction-W & Z Bosons. Parity non-conservation in weak interactions, Quark hypothesis, **Applications of particle physics Fusion reactors:**		

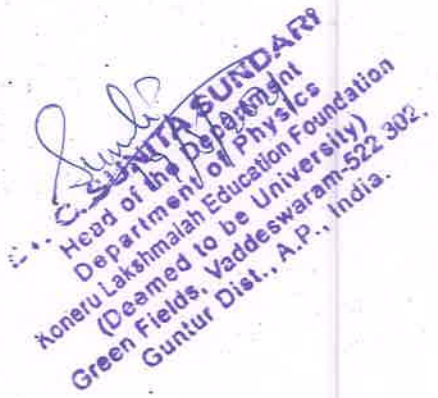
			introduction for Scientists – G.D.Coughlan, J.E.Dodd and B.M.Gripaios, Cambridge University Press(1984). 4. Techniques for Nuclear and Particle Physics experiments – William. R. Leo 5. Introduction to Elementary Particles by D. J. Griffiths (Academic Press 2nd Ed.2008) **Reference Books:** 1. Quarks and Leptons: An Introductory Course in Modern Particle Physics – F. Halzen and A.D.Martin, John Wiley & Sons (!983) 2. Quarks and Leptons: An Introductory Course in Modern Particle Physics by Halzen and Martin (Wiley) 3. Introduction to Particle Physics: M.P. Khanna (Prentice Hall of India, New Delhi), 2004 Facts and Mysteries in Elementary Particle Physics – Martinus Veltman, World Scientific (2003)	Mossbauer Spectroscopy – Applications in medicine: Basics of heavy ion therapy for cancer treatments – **Text Books:** 6. Introduction to Nuclear and Particle Physics by Ashok Das and Thomas Ferbel (World Scientific). 7. Introduction to High Energy Physics – D.H.Perkins, Addison Wesley, Reading, Mass (1982) 8. The ideas of Particle Physics:An introduction for Scientists – G.D.Coughlan, J.E.Dodd and B.M.Gripaios, Cambridge		

				University Press(1984). 9. Introduction to Elementary Particles by D. J. Griffiths (Academic Press 2nd Ed.2008) **Reference Books:** 4. Quarks and Leptons: An Introductory Course in Modern Particle Physics – F. Halzen and A.D.Martin, John Wiley & Sons (!983) 5. Quarks and Leptons: An Introductory Course in Modern Particle Physics by Halzen and Martin (Wiley) 6. Introduction to Particle Physics: M.P. Khanna		

				(Prentice Hall of India, New Delhi), 2004 Facts and Mysteries in Elementary Particle Physics – Martinus Veltman, World Scientific (2003)		
21PH5207	Digital Electronics Lab	1. LED Control Using Universal Gates 2. Combinational Circuit Based Car Security System 3. Participant selection in Competitions Using Multiplexer 4. Digital Display of Department Name 5. Random Number Generator for Gaming Using D-Flip- flop 6. Design of Automobile garage control system using counters 7. Digital Unlocking System using Shift Register Digital Data Storage Using Semiconductor Memories	1. Verification of Logic Gates and Universal Logic Gates 2. Construction of Logic gates by Universal Logic gates 3. De-Morgan's Theorem 4. Construction of Logic gate circuit by Boolean Problem 5. Construction of the Combinational Circuits (Half adder and Full adder) 6. Construction and verification of the A/D and D/A conversion circuits 7. Construction and verification of the Encoder and Decoder Circuits with truth table 8. Construction and verification of the Multiplexer and De multiplexer Circuits 9. Verification of Flip-Flops (Latch, SR flip-flop, D flip-flop, T flip-flop) 10. Verification of Flip-Flops (JK flip-flop, Master slave JK flip-flop)	**Removed topics** Digital Display of Department Name Topics Added 1. De-Morgan's Theorem 2. Construction of Logic gate circuit by Boolean Problem 3. Construction of the Combinational Circuits (Half adder and Full adder) 4. Construction and verification of the A/D and D/A conversion		20

			11. Registers: Serial in serial Out and Serial in Parallel Out 12. Registers: Parallel in serial Out and Parallel in parallel Out 13. Counters: Synchronous Counters/ Asynchronous Counters 14. Design of Automobile garage control system using counters 15. Construction of Combinational Circuit Based Car Security System Design of Traffic signals by using Counters	circuits 5. Construction and verification of the Encoder and Decoder Circuits with truth table 6. Construction and verification of the Multiplexer and De multiplexer Circuits 7. Registers: Serial in serial Out and Serial in Parallel Out 8. Registers: Parallel in serial Out and Parallel in parallel Out 9. Counters: Synchronous Counters/ Asynchronous Counters 10. Design of Automobile garage control system using		

				counters 11. Construction of Combinational Circuit Based Car Security System Design of Traffic signals by using Counters		



Annexure-2

21PHY206- PHYSICS OF SOLAR CELLS

Syllabus

Unit – I: Fundamentals of Solar cells

Energy scenario - Renewable Energy sources - Economic Analysis of Renewable Energy System - Solar radiation: Solar constant - Solar Spectra - Air Mass - Global radiation - Position of the Sun.

Insolation Physics of Solar cells: Fundamental Properties of Semiconductors - conversion of solar energy, photochemical conversion of solar energy - photovoltaic conversion - photo physics of semiconductors - photocatalysis - Band model - Doping - Semiconductor types - absorption of light - recombination - p-n junction - Solar cells - Solar cell parameters - Spectral response - Upper limits of cell parameters - Thermodynamic limit-the Schokley-Quiesser limit - effect of temperature - effect of parasitic resistances.

Unit – II: SOLAR PV TECHNOLOGIES (qualitative):

Description of the photovoltaic effect – Electrical characteristics calibration and efficiency measurement.

First generation: Silicon wafer-based technology: Design of Crystalline Silicon Solar Cells - loss mechanism - silicon feed stock - production of silicon wafers - Manufacturing process of c-Si solar cells - high efficiency approaches - PERL and PERC cells - interdigitated back contacts – TOP Con - heterojunction solar cells - lab to industry requirements.

Second generation: Thin film technologies: Merits and demerits of thin film technologies - Transparent conducting oxides - GaAs, amorphous-Si, CdTe and CIGS solar cells, a-Si and Tandem solar cells, Multi-junction cells, Emerging PV: DSSC - Organic solar cells -Perovskite -Quantum Dots.

Third generation/emerging PV technologies: Organic PV - organic-inorganic hybrid solar cells - Quantum-dot - Hot-carrier - Up conversion and down conversion

Unit – III: HIGH EFFICIENCY CONCEPTS IN SOLAR CELLS

Heterojunction solar cells Second generation technology: Thin film solar cells - merits and demerits -Transparent conducting oxides - the III-V PV technology - thin film Si technology - Chalcogenide solar cells - Organic and inorganic photovoltaics - efficiency of DSSCs.

Hybrid organic-inorganic solar cells Third generation concepts: Multi junction solar cells - Spectral conversion - Multi- exciton generation - Intermediate band solar cells - Hot carrier solar cells Module manufacturing: Interconnection of cells series and parallel connections- silicon module production - PV systems: Standalone systems - grid-connected systems - hybrid systems - micro grids - smart grids - specific applications

Unit – IV: GOVERNING DIFFERENTIAL EQUATIONS AND DISCRETISATION TECHNIQUES

Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications - Basics of Heat Transfer, Fluid flow – Mathematical description of fluid flow and heat transfer – Classification of partial differential equations – Initial and Boundary Conditions – Taylor's Series - Uniform and non-uniform Grids - Numerical Errors.

Unit – V: ENERGY LEVELS AND SPECTRA - CHARACTERISTICS:
Basic characteristics solar cell light intensity - temperature and light spectra the short-circuit current (I_{SC}) - open-circuit voltage (V_{OC}) - fill factor (FF) - solar energy conversion efficiency (η) - Influence of the series resistance (R_s) - parallel resistance (R_p) - Principle work with various kinds of load resistances - function pyranometer - quantum efficiency in solar cells - Errors in measurements - Statistical analysis of data - Regression analysis – correlation - estimation of uncertainty data - experiments factors and protocols. Polarization rotation - Effective band gap engineering -Vibrations - Rotational Energy of Spherical - Rotational Raman - IR Spectra of linear molecules - Influence of Nuclear Spin on Rotational Raman Spectrum – Rotation - **Software for fitting:** Peakfit, Origin, **Software for spectra and vibration analysis:** Crystal sleuth, Raman and IR mode calculation, Vibration analysis.

TEXT BOOKS:

1. Duffie, J.A., and Beckman, W.A. Solar Energy Thermal Process - 4 th Edition (2013), John Wiley and Sons, New York, ISBN: 978-0-470-87366-3, Solar Energy Laboratory, University of Wisconsin-Madison, pp. 944.
2. M. Stix, The Sun, An Introduction, Second Edition, Springer 2002.
3. Jenny Nelson, The Physics of Solar Cells. Imperial College Press, 2003
4. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications (2011), 2nd edition, PHI Publications, pp. 512.
5. Sukhatme S.P. J K Nayak, Solar Energy, Tata McGraw Hills P Co., ISBN: 9789352607112, 4th Edition, 2017, pp. 568.
6. C. Julian Chen, Physics of Solar Energy (2011), ISBN: 978-1-118-04832-0, pp. 352.
7. K. Mertens, Photovoltaics: Fundametals, Technology and Practice, John Wiley & Sons Ltd (2014)
8. Handbook of Photovoltaic Science and Engineering 2nd Ed. , A. Luque, S. Hegedus (editors), John Wiley & Sons Ltd (2011)
9. A. Smets, K. Jager, O. Isabella, R. V. Swaaij, M. Zeman, Solar Energy: The physics and engineering of photovoltaic conversion, technologies and systems, UIT Cambridge Ltd. (2016).
10. S.R. Wenham, M. Green, M.E. Watt, R. Corkish, A. Sproul, Applied Photovoltaics ? 2nd Edition (2009)
11. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and applications, 3rd Edition, PHI Learning Pvt. Ltd. (2019).
12. Jenny Nelson, The Physics of Solar Cells, Imperial College Press (2003).
13. Peter Wurfel, Physics of solar cells: from principles to advanced concepts, 2nd Edition, WileyVCH (2009).

Reference Books:

1. Chemical Applications of Group Theory : F.A. Cotton.
2. Fundamentals of Molecular Spectroscopy : C.N. Banwell.

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3. Introduction to Molecular Spectroscopy : G.M. Barrow.
4. Modern Spectroscopy : J.M. Hollas.
5. D. A. Neamen and D. Biswas, Semiconductor Physics and Devices
6. R.F. Pierret, Semiconductor Device Fundamentals
7. SM Sze and Kwok K Ng, Physics of semiconductor devices, third edition ,John Wiley & Sons (2007)

21PHY309- ADVANCED SOLAR ENERGY STORAGE TECHNOLOGIES

Syllabus

Unit – I: ENERGY STORAGE

Necessity of storage for solar energy.- Chemical energy storage - Thermal energy storage - Thermal Flywheels - Compressed air energy storage- Rechargeable batteries - Thermal Storage Concepts - Materials for Sensible and Latent Heat Energy Storage. Organic, Inorganic Eutectic Materials, Materials for Low and High Temperature Storage Applications. Chemical storage Concepts - Rechargeable Batteries – Types, Operating range, Comparison and suitability for various applications - Super Capacitors

Unit – II: SOLAR WATER HEATING SYSTEMS

Thermal storage – Types – Modelling of thermal storage units – Modelling of phase change storage system - Modelling using porous medium approach - Integral Collector Storage System - Thermosyphon System - Open Loop, Drain Down, Drain Back, Antifreeze Systems - Refrigerant Solar Water Heaters - Solar Heated Pools - Solar Heated Hot Tubs and Spas. Basics of absorption cooling - Principle of absorption cooling - Solar operation of vapour absorption refrigeration cycle - Open cycle absorption / desorption solar cooling alternatives.– Lithium Bromide- Water absorption System – Aqua-ammonia absorption system – Intermittent absorption refrigeration System - Refrigerant storage for solar absorption cooling systems.

Unit – III: SOLAR SPACE CONDITIONING SYSTEMS

Liquid Type Solar Heating System With / Without Storage - Heat Storage Configurations – Heat Delivery Methods - Air-Type Solar Heating Systems - Solar Refrigeration and Air Conditioning. Solar Parabolic trough - Basic definition of Pollution Indicators – Noise Pollution - Transformation Technologies for Waste Treatment – Classification and characteristics of Composite materials – Biomass pyrolysis – Bio-energy.

Unit – IV: OTHER SOLAR APPLICATIONS

Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – domestic, community – Solar pond – Solar drying-solar chimney-solar thermal electricity conversion.

Introduction – Necessity for desalination – Study on various desalination techniques – Comparison between conventional and solar desalination – Basics of solar still - Simple solar still – Material problems in solar still – Solar disinfection and its methods – Case studies on various desalination techniques.

Introduction – Types of solar cookers – Advantages and disadvantages - Box type – Parabolic dish cooker - Performance evaluation of solar cookers – Testing of a solar cooker – Applications of solar cooking - Case studies

Unit – V: SOLAR PASSIVE ARCHITECTURE

Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain – indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - Radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – energy efficient landscape design - thermal comfort - Application of economic methods

Text Books:

1. Versteeg and Malalasekera, N, "An Introduction to computational Fluid Dynamics the Finite Volume Method," Pearson Education, Ltd., Second Edition, 2014.
2. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer " Hemisphere Publishing Corporation, New York, USA,1984

PROPOSED AND REVISED M. SC (PHYSICS) COURSE STRUCTURE FOR Y21 (2021-22) (CHOICE BASED CREDIT SYSTEM (CBCS))

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-Requisite	New Course/Revised Course/ Retained Course	Focused on
1	21PH5101	Mathematical Physics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
2	21PH5102	Classical Mechanics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
3	21PH5103	Electrodynamics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
4	21PH5104	Analog Electronics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
5	21PH5105	Computational Physics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability/Skilling
6	21PH5106	Analog Electronics Lab	PC/M	0	0	6	0	3	6	NIL	Revised	Employability
7	21PH5107	Computational Physics Lab	PC/M	0	0	4	0	2	4	NIL	Retained	Employability
8	218PH5108	Seminar-1	PC/M	0	0	2	0	1	2	NIL	Removed	Skilling
9	21PH5201	Statistical Mechanics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
10	21PH5202	Quantum Mechanics-1	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
11	21PH5203	Fiber Optics and Non-linear optics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
12	21PH5204	Solid State Physics-1	PC/M	4	0	0	0	4	4	NIL	Revised	Employability
13	21PH5205	Digital Electronics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
14	21PH5206	Solid State Physics-1 Lab	PC/M	0	0	6	0	3	6	NIL	Retained	Skilling
15	21PH5207	Digital Electronics Lab	PC/M	0	0	4	0	2	4	NIL	Revised	Skilling
16	21PH5208	Seminar-2	PC/M	0	0	2	0	1	2	NIL	Retained	Skilling
17	20UC1102	Design Thinking and Innavoation-1	UC	1	0	0	4	2	5	NIL	Retained	Skilling/ Entrepreneurship
18	21PH5301	Quantum Mechanics-2	PC/M	4	0	0	0	4	4	Q M-1	Retained	Employability
19	21PH5302	Atomic and Molecular Spectroscopy	PC/M	4	0	0	0	4	4	NIL	Retained	Employability

20	21PH5303	Nuclear Physics	PC/M	2	0	0	0	2	2	NIL	Revised	Employability
21	21PH5304	Particle Physics	PC/M	2	0	0	0	2	2	NIL	Revised	Employability
22	21PH5305	Solid State Physics-2	PC/M	4	0	0	0	4	4	NIL	Revised	Employability
23	21PH5306	Lasers and Photonics	PC/M	4	0	0	0	4	4	NIL	Retained	Employability
24	21PH5307	Term Paper	PC/M	0	0	4	0	2	4	NIL	Retained	Skilling
25	21PH5308	Solid State Physics-2 Lab	PC/M	0	0	6	0	3	6	NIL	Revised	Skilling
26	20UC1203	Design Thinking and Innovation -2	UC	1	0	0	4	2	5	NIL	Retained	Skilling/ Entrepreneurship
27	21PH5401	Dissertation with Published Paper	PC/M	0	0	16	0	8	16	NIL	Retained	Skilling
		Electives								NIL		
		Elective-1										
28	21PH54E1	Experimental Techniques	PE	3	0	0	0	3	3	NIL	Retained	Employability
	21PH54E2	Basic Communication Theory	PE	3	0	0	0	3	3	NIL	Retained	Employability
		Elective-2									Retained	
29	21PH54E3	Physics of Nanomaterials	PE	3	0	0	0	3	3	NIL	Retained	Employability
	21PH54E4	Radar Systems and Satellite Communication	PE	3	0	0	0	3	3	NIL	Retained	Employability
		Elective-3										
30	21PH54E5	Thin film Technology	PE	3	0	0	0	3	3	NIL	Retained	Employability
	21PH54E6	Antenna Theory and Radiowave Propagation	PE	3	0	0	0	3	3	NIL	Retained	Employability
				71	**0**	**48**	**8**	**97**	**127**			

Percentage of Courses focusing on Employability= No. of courses focusing on Employability/ Total number of courses=29=72.4
Percentage of Courses focusing on Entrepreneurship= No. of courses focusing on Entrepreneurship / Total number of courses=2/29=6.89
Percentage of Courses focusing on Skill Development = No. of courses focusing on Skill Development / Total number of courses=9/29=31.03

Reference for Program Structures and Syllabus Revision

S.No	Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/ Replaced	Change in outcome	Justification for modification	Revision Percentage
1	21PH5101	Mathematical Physics	Professional core	-	-	-	-	-	-
2	21PH5102	Classical Mechanics	Professional core	-	-	-	-	-	-
3	21PH5103	Electrodynamics	Professional core	-	-	-	-	-	-
4	21PH5104	Analog Electronics	Professional core	-	-	Annexure-1	-	-	20
5	21PH5105	Computational Physics	Professional core	-	-	-	-	-	-
6	21PH5106	Analog Electronics Lab	Professional core	-	-	-	-	-	-
7	21PH5107	Computational Physics Lab	Professional core	-	-	-	-	-	-
8	21PH5108	Seminar-1	Skilling	-	-	-	-	-	-Removed
9	21PH5201	Statistical Mechanics	Professional core	-	-	-	-	-	-
10	21PH5202	Quantum Mechanics-1	Professional core	-	-	-	-	-	-
11	21PH5203	Fiber Optics and Non-linear optics	Professional core	-	-	-	-	-	-
12	21PH5204	Solid State Physics-1	Professional core	-	-	-	-	-	-
13	21PH5205	Digital Electronics	Professional core	-	-	-	-	-	-

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14	21PH5206	Solid State Physics-1 Lab	**Professional core**	-	-	-	-	-	-
15	21PH5207	Digital Electronics Lab	**Professional core**	-	-	**Annexure-1**	-	-	**20**
16	21PH5208	Seminar	**Professional core**	-	-	-	-	-	**Modified**
17	20UC1104	Design Thinking and Innavoation	**UC**	-	-	-	-		**Modified**
18	21PH5301	Quantum Mechanics-2	**UC**	-	-	-	-	-	-
19	21PH5302	Atomic and Molecular Spectroscopy	**Professional Core**	-	-	-	-	-	-
20	21PH5303	Nuclear Physics	**Professional Core**	-	-	**Annexure-1**	-	-	**20**
21	21PH5304	Particle Physics	**Professional Core**	-	-	**Annexure-1**	-	-	**20**
22	21PH5305	Solid State Physics-2	**Professional Core**	-	-	-	-	-	-
23	21PH5306	Lasers and Photonics	**Professional Core**	-	-	-	-	-	-
24	21PH5307	Term Paper	**Professional Core**	-	-	-	-	-	-
25	21PH5308	Solid State Physics-2 Lab	**Professional Core**	-	-	-	-	-	-
26	20UC1203	Design Thinking and Innavoation-2	**Skilling/Entrepreneurship**	-	-	-	-	-	**Removed**
27	21PH5401	Dissertation with	**Skilling**	-	-	-	-	-	-

		Published Paper							
28	21PH54E1	Experimental Techniques	**Professional Elective**	-	-	-	-	-	-
29	21PH54E2	Basic Communication Theory	**Professional Elective**	-	-	-	-	-	-
30	21PH54E3	Physics of Nanomaterials	**Professional Elective**	-	-	-	-	-	-
31	21PH54E4	Radar Systems and Satellite Communication	**Professional Elective**	-	-	-	-	-	-
32	21PH54E5	Thin film Technology	**Professional Elective**	-	-	-	-	-	-
33	21PH54E6	Antenna Theory and Radiowave Propagation	**Professional Elective**	-	-	-	-	-	-
	Average percentage of revision= (sum of revision in all courses/ Total no. of courses)								**2.75**

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DEPARTMENT OF PHYSICS
MINUTES OF DEPARTMENT ACADEMIC COMMITTEE (DAC)

The Department Academic Committee (DAC) Meeting was conducted at 11:00 A.M. on 20/02/2021 in the virtual mode due to the prevailing pandemic (COVID-19), with HoD in the chair and the concerned Committee members.

Cisco WebEx virtual mode:
https://kluniversity.webex.com/kluniversity/e.php?MTID=mf9e5f62766bd854898367cf1a790586b

Agenda of the Meeting:

1. To revise the syllabus of Y20 curriculum in MSc Physics
2. To add two research-oriented courses in Pre-PhD Physics curriculum
3. To include certificate courses in MSc Physics
4. Any other item with the permission of the chair

The following Faculty Members were present:

1. Dr. G. Sunita Sundari, Associate Professor, Group Head- CNT, & Head of the Dept.
2. Dr. N.S.M.P. Latha Devi, Associate Professor
3. Dr. K. Swapna, Associate Professor
4. Dr. Mahamuda Shaik, Associate Professor
5. Dr. K. Raghavendra Kumar, Associate Professor & PG Coordinator
6. Dr. M.V.V.K. Srinivas Prasad, Assistant Professor & Associate Dean (Academics)
7. Dr. M. Venkateswarlu, Assistant Professor & Prof. In-Charge
8. Dr. A. Venkateswara Rao, Assistant Professor, RPAC Chairman
9. Dr. Shaik Babu, Assistant Professor & Deputy HoD
10. Dr. A. Sendil Kumar, Assistant Professor & Counselling In-Charge
11. Dr. S. Shanmugan, Assistant Professor
12. Mr. M. Gnana Kiran, Assistant Professor & Associate Dean (P & D)

Dr. G. Sunita Sundari, Assoc. Prof. & Head, Department of Physics welcomed all committee members to the DAC meeting and hosted the meeting in virtual mode due to COVID-19 pandemic.

As per the guidelines received from the Dean-Academics, also for enhancing the career prospects of the students, the DAC members discussed the following points and the same is recommended to the BOS-Chair.

After due deliberations, the following resolutions have been discussed and adopted:

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AGENDA and RESOLUTIONS

AGENDA ITEM-1

To revise the syllabus of Y20 curriculum in MSc Physics (Analog Electronics (19PH5104); Nuclear Physics (19PH5303); Particle Physics (19PH5304)).	Approved and recommend to the BoS for approval

As per the guidelines received from the committee members, also for enhancing the career prospects of the students, the DAC members discussed about to revise the syllabus of Y19 curriculum in MSc Physics (Analog Electronics (19PH5104); Nuclear Physics (19PH5303); Particle Physics (19PH5304)) and implement the same from the Y21 admitted batch students. The same is accepted and recommended by the BOS chairman and other committee members with the following revised course codes.

Analog Electronics – 21PH5104
Nuclear Physics – 21PH5303
Particle Physics – 21PH5304

AGENDA ITEM-2

To increase course conducting hours and credits in the existing Digital Electronics lab (19PH5207)	Approved and recommend to the BoS for approval

Considering the suggestions and recommendations given by the internal committee members and course coordinators (CCs), we are increasing the credit and contact hours for the existing course Digital Electronics Lab (19PH5207) without any revision of course content. All the committee members attended in the DAC meeting approved the modified total number of credits, and hence, the same is recommended to the BOS Chairman for approval.

AGENDA ITEM-3

To remove the Seminar-2 course (19PH5208) from the MSc Physics curriculum	Approved and recommend to the BoS for approval

With reference to the feedback given by students and alumni, the seminar-2 (19PH5208) is removed from the curriculum. In addition to that we have shifted the seminar-1 course and presented as a single course in second semester of first year. The same is accepted and recommended by the BOS chairman and other committee members with the following revised course code.

Seminar – 21PH5208

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AGENDA ITEM-4

To include Design Thinking and Innovation (DTI) – 1 & 2 courses in to the M.Sc (Physics) Curriculum for the Y19 admitted batch students	Approved and recommend to the BoS for approval

As per the guidelines received from the Dean-Academics, also for enhancing the career prospects of the students, the DAC members discussed about to include Design Thinking and Innovation (DTI) – 1 & 2 courses in semester 3 and semester 4, respectively in to the Y21 M.Sc (Physics) Curriculum and the same will implemented in regular courses for the next admitted batch students too. The same is accepted and recommended by the BOS chairman and other committee members with the following proposed structure.

Design Thinking and Innovation - 1 (DTI-1) course with 2 Credits with L-T-P-S _ 1-0-0-4
Design Thinking and Innovation - 2 (DTI-2) course with 2 credits with L-T-P-S _ 1-0-0-4

AGENDA ITEM-5

To include two research-oriented courses for the existing Pre-PhD Physics curriculum.	Approved and recommend to the BoS for approval

As per the guidelines received from the committee members and faculty, we have introduced new research-oriented courses for the existing Pre-PhD Physics curriculum. The same is accepted and recommended by the BOS chairman and other committee members with the following revised course codes.

Physics of Solar Cells – 21PHY206
Advanced Solar Energy Storage Technologies – 21PHY309

Considering the suggestions and recommendations given by the internal members, we are going to change with the addition or deletion of topics from the Y19 MSc Physics curriculum for the above-mentioned courses.

All the members attended in the DAC meeting approved the modified curriculum, and hence, the same is recommended to the BOS-Chairman for the approval

Dr.G. Sunita Sundari
Chairman DAC - Physics

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