P.R. GOVERNMENT COLLEGE (A), KAKINADA

(AN AUTONOMOUS COLLEGE WITH NAAC "A" GRADE)

Board of Studies Meeting for PG Programmes

PHYSICS

2022 – 2023

DEPARTMENT
OF
PHYSICS

P. R. GOVT. COLLEGE (A), KAKINADA

DEPARTMENT OF PHYSICS & ELECTRONICS

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DEPARTMENT OF COLLEGIATE EDUCATIONGOVERNMENT OF ANDHRA PRADESH

PROCEEDINGS OF THE PRINCIPAL, PITHAPUR RAJAH's GOVT. COLLEGE[A]:: KAKINADA

Present: Dr. B.V. TIRUPANYAM, Ph.D.

Rc.No.12A/ A.C/BOS/2022-23 Dt.24 Sept'2022

Sub: P.R.G.C[A] – Academic Cell - **Conduct of BOS Meetings for the Academic Year2022-23** – Guidelines issued - Regarding.

Ref: 1. Minutes of IQAC meeting dated 18 September 2022

2. Resolutions adopted in 22nd Staff Council Meeting held on 23 Sept 2022

PREAMBLE

The Autonomous colleges are, as per its vision, mission, stated objectives and core values, mandated to design and develop their own outcome -based curricula keeping in view the societal, local and global industry requirements, employability and industry – ready and transferable skills duly prescribing Course Outcomes (COs), Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) and suitable learning outcome assessment management system through robust and transparent evaluation system to measure their attainment levels of the students.

The Sustained Developmental Goals (SDG-4) of UNEP recommended assurance of quality to students in HEIs promoting creativity, critical thinking and collaborative skills, while building curiosity, courage, resilience and gender equality among students.

Further, the NEP-2020 recommended that the HEIs shall equip students with such skills that translate them into leaders and potential entrepreneurs too besides credit transfer mechanism through ABC (Academic Bank of Credits).

The HEIs are also, as per the Revised Accreditation Framework [RAF] of NAAC, endowed with the responsibility of rolling out quality and holistic human resources to the modern Indian Economy by ingraining quality in teaching- learning process by facilitating the students experience a wide range of participative and experiential learning strategies including field trips, conferences, integration of technology, community service

programmes, career guidance, certificate and value added courses, research and inquisition based teaching, exchange programmes, gender equity programmes, etc.

Besides, the students shall have social consciousness, regard for constitutional provisions, right perspective on environmental protection, awareness on gender equity, health and hygiene, Yoga and wellness, college social responsibility, culture and values, etc., to mention a few.

Further, the Ministry of India, GoI, through NIRF, prescribes quality research, infrastructure augmentation, enhanced placement and progression to higher education, equipment of employability skills leading to enhanced public perception about the college among the public.

Our institution has, from AY 2022-23, has devised its new vision and mission along with objectives and core values necessitating design and re-orientation of its academic administration in tune with them.

ORDER:

In the light of the above mandate and responsibilities prescribed by institutions vision and mission, SDG-4, NEP – 2020, NAAC, NIRF to the autonomous HEIs, need to customize, design and re-orient their academic and research administration in tune with the policies of above bodies, our insitution is no exception.Hence, the Chairmen of U.G and P.G Boards of Studies of various Departments are requested to make necessary arrangements for the conduct of the meetings separately between 11 October 2022 and 15 October 2022. They are further requested to prepare curricula and extracurricular activities and devise suitable evaluation system keeping in mind above recommendations to make students a wholesome personality and a 21st century student capable of facing challenges, adaptive to changes, creative and innovative.

Further, the Chairman of the each BOS, in association with the IQAC coordinator, preceding the BOS meeting, is requested to prescribe benchmarking, quality initiatives in pedagogy and learning; in design of curriculum (with 20% change) and optimum utilization of existing human, physical and ICT resources and adopt resolutions to the extent of benchmarks (As per SOP given in Annexure – I). Further, as the regular attendance of students to the classes is a deciding factor in enhancement of quality in

learning, a minimum attendance of 60% for I mid-term examination, 75% for II mid-term examination under CIA component shall be the benchmark for attendance and it shall be approved in the BOS. The Chairmen are also requested to approve the new programmes to be introduced for 2022-23, if any, number of certificate courses, their frequency, Bloom's-Taxonomy based evaluation system for effective learning outcomes as per the Annexure - I

The Chairmen are, therefore, requested to

- Design curricula of Odd and even semesters for the A.Y 2022-23 both for U.G and P.G courses in tune withthe stated vision, mission of the institution, RAF of NAAC, NEP-2020 and NIRF.
- Conduct meeting with employers, parents, alumni, shall take feedback on the existing curricula andinvite suggestions and changes to be made.
- Invite the University nominee, subject experts, industrial nominees, student nominees, parents well in advance along with the date, venue, agenda, etc. A soft copy shall be communicated well in advance to the members to have an idea on the matters.
- Facilitate much room for intense deliberation on the design of the curricula, evaluation system, research component, enhancing learning experiences, resource utilization by staff ad students, etc.,
- Each Department shall approve and recommend additional credits for additional modules, training programmes, N.S.S, N.C.C, participation in cultural programs, sports and games, environmental programs, blood donations camps, etc.

- All meetings shall be offline. Online attendance of members faculty will be permitted only in exceptional cases.
- The Chairmen shall submit minutes of the meeting in the prescribed format only (Annexure – II) in triplicate(hard copies) to the Academic cell for onward submission to the IQAC, Examination cell and library within three days from the completion of BOS meeting and besides hosting the soft copy in the college website within the period stipulated.
- Each Chairman of BOS, shall get the rough draft of the curricula verified and approved by the Principal, Academic Cell and IQAC before the actual BOS meetings to ensure uniformity and commensurate with the stated vision and mission of the college among the departments.
- The Academic Cell coordinator shall be the Chief Coordinator for the BOS meeting activity and IQACcoordinator will be the additional coordinator.
- The Academic Coordinator and IQAC coordinator shall conduct a meeting with the Chairmen, BOS between 28-29 September 2022 and explain the structure of curricula, uniformity other modalities.
- The Controller of Examinations of the institution shall fund the BOS meetings from the available

funds on the condition of reimbursement after receiving autonomous funds from UGC. Initially, he shall pay Rs. 5,000/- uniformly as an advance per Board to the respective Chairman (If BOS meetings for multiple Boards are to be held under one Chairmanship, he/ she shall be given advance amount equivalent to the number of Boards x Rs.5000/-.

- The Chairman of each BOS shall apply to the Principal for advance amount for meeting the BOS meetings with head-wise expenditure in the prescribed format (Annexure-III).

Following contents shall be presented in the BOS document in order

1. Proceedings of the Principal pertaining to BOS
2. Composition of BOS
3. Vision and Mission of the college
4. Agenda: It shall include ATR on the previous BOS meeting first, resolutions, etc., later.
5. Table showing the Allocation of Credits in the following table for both theory and Lab in case of sciencesubjects

S. No	Semester	Title of the Course (Paper)	Hrs./ week	Max. Marks (SEE)	Marks in CIA	Credits
1	III	Optics	4	50	50	4

6. Resolutions adopted in the meeting with detailed discussion that took place during the meeting (Activities and Benchmarking as per Annexure –I)

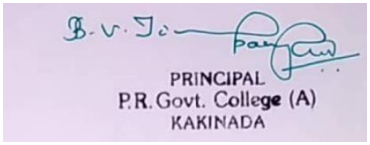
7. At the end of each theory paper, each topic shall be mapped as per the Blooms taxonomy and scope of that topic for skill/ employability/ entrepreneurship opportunities in the followingtable incorporated

S. No	Subject	Semester	Title of the Course (Paper)	Topic	Parameter as per Blooms taxonomy (Knowledge / Application/ Creativity/ Innovation	Experiential learning component	Scope (Skill/ employability/ entrepreneurship)
1	III	Botany	Plant Physiology	Plant Cell	Knowledge	Shall be shown Microscope	
2	III	History	Tourism	Tourism management	Application	Apprenticeship	Employability

8 Each BOS Chairman shall, immediately after syllabus, tabulate the changes made in

the syllabus/ paper along with justification, in the Proforma given in Annexure – I.

1. Attendance of Members present with signatures in the tabular form.
2. List of Examiners & Paper setters
3. Syllabus for each course (both theory & Practical in case of Science subjects) followed by model question papers (theory & practical) and allocation of CIA (50marks) for each course with structure.
4. CO-PO mapping /PO attainment data
5. Text & Reference Books
6. e-content links



PRINCIPAL
Pithapur Rajah's **Government AutonomousCollege**

Kakinada

Enclosures: Annexures- I, II & IIICopy to:

Lecturers-in-Charge (BOS Chairmen) of all the departmentsIQAC coordinator
Controller of Examinations Office

PROCEEDINGS OF THE PRINCIPAL, P.R. GOVERNMENT COLLEGE(A), KAKINADA–A.P.

Present: Dr. B.V. Tirupanyam, M.Sc; Ph.D.

R.C. No.12A/A.C./BOS/2022-23, Dated: 24.09.2022

SUB: P.R.Government College (A), Kakinada - PG Boards of Studies (BoS)- Program/ Course - M.Sc./ PHYSICS, Nomination of Members – Orders issued

REF: 1. UGC Guidelines of for Autonomous Colleges-2018.

ORDER:

The Principal, P.R.Government College (A), Kakinada is pleased to constitute PG Boards of Studies in Physics for framing the syllabi in Physics subject for all semesters duly following the norms of the UGC Autonomous guidelines.

S.No.	Name of the Nominee	Designation
1	Sri U.V.B.B. Krishna Prasad; Head of the Department	Chairman
2	Dr. P. Paul Diwakar	University nominee, Y.V.N.R. Government College, Kaikaluru.
3	Dr. K. Jyothi	Subject Expert; Principal;SVRKGDC(M), Nidadavolu
4	Dr.M.V.K. Meher	Subject Expert; Principal; GDC; Perumaallapuram
5	Mr.Suresh Kumar Pitta,	Representative from Industry, JVS Technologies, Kakinada
6	Dr. K. Nanda Gopal	Sr. Scientific Asst., Indian Meteorology Department., Alumni
7	Smt. M. Surekha	Member
8	Dr. K.Jayadev	Member
9	Ms. G. Sridevi	Member
10	Sri R. Tejeswara Rao	Member
11	Dr.SVGVA Prasad	Member
12	Sri P. Himakar	Member
13	Sri B.Srikanth	Member
14	K. Durga Rao	Member
15	Mr.P.Veerendra	Member
16	Ms.D.Sravani	Member
17	Kum.Ch.N,Swapna	Student Member -; IIM.Sc
18	Kum. Y.Sneha Latha	Student Member; IM.Sc

The above members are requested to attend the BOS meeting on **-10-2022** and share their valuable views, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council
- Suggest methodologies for innovative teaching and evaluation techniques
- Suggest the panel of names to the Academic Council for appointment of Examiners
- Coordinate research, teaching, extension and other activities in the Department of the College.

B. V. T.
PRINCIPAL
1 Oct'2022
Government College (A), Kakinada

PRINCIPAL

M.Sc

Vision & Mission of the College

VISION: To contribute its might for holistic and quality human capital formation for modern economy with focus on developing employment opportunity – enhancing skilling ecosystem, through integration of research, value system and technology into teaching – learning process.

MISSION:

- To provide conducive and outcome-based skill development environment in the institution to brighten prospects for progression to higher education, employment opportunities in Government and Private agencies, for personal growth and enhanced productivity and economic growth.
- To collaborate with coaching centres or skill development institutions for skill development.
- To develop systems for quality enhancement in learning by student through promotion of ICT integration into learning, deployment of learning resources at the door steps of students for optimum utilization.
- Designing and implementing student-centric, inquisitive, practical-rich and research based curricula, including project works, problem-solving & applications oriented TLPs, field trips, etc., that facilitate experiential and participative learning.
- To strengthen research and development and create new research knowledge through intense research, collaborations, knowledge and technology transfer.
- To foster innovation among students through trainings and forging collaborations with outside organizations
- To turn each student into a wholesome personality through initiatives in Community Service, Gender equity initiatives, Environment protection, personality development, transferable skills, understanding constitution and its spirit and their role in nation building.
- To mould the character of each constitutional provisions-abiding and inquisition-arousing

P.R. Government College (Autonomous), Kakinada
Department of Physics
Recommended Composition and Functions of the Board of Studies of M.Sc. Physics : 2022-23

I. **Composition**:

1. Head of the Department concerned (Chairman): Sri U.V.B.B. Krishna Prasad M.Sc., M.Phil., B.Ed.
2. The entire faculty of each specialization.
   - M. Surekha
   - Dr. K. Jayadev
   - G. Sridevi
   - A.Padmavathi
   - Dr. S.V.G.V.A. Prasad
   - P. Himakar
   - B. Srikanth
   - K. Durga Rao
   - P.Veerendra
   - D.Sravani
3. One expert to be nominated by the Vice-Chancellor Dr. P. Paul Diwakar, Lecturer in Physics, Y.V.N.R. Govt. Degree College, Kaikaluru.
4. One subject expert in the subject from outside the college to be nominated by the Academic Council Dr. K. Jyothi, Principal, Government College for men, Nidadavole.
5. Another subject expert in the subject from outside the college to be nominated by the Academic Council Dr. M.V.K. Mehar, Principal, Government College, Perumallapuram.
6. One representative from industry/ Corporate Sector/ allied area relating to Placement. Sri B.Sudharsan Andhra Electronics, Kakinada.
7. One postgraduate meritorious alumnus to be nominated by the principal. The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt. Dr. K. Nanda gopal (Student Alumni Member)

II. **Term:** The term of the nominated members shall be two years.

III. **Meeting:** The Principal of the college shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once in a year.

IV. **Functions:** The Board of Studies of a Department in the College shall:

- Prepare syllabus and various courses keeping in view the objectives of the College interest of the stakeholders and according to the timely revision of syllabus of APSCHE & UGC on the national interest for the consideration and approval of the Academic Council.
- Suggest methodologies for innovative teaching and evaluation techniques.
- Suggest panel of names to the Academic Council for appointment of examiners.
- Coordinate research, Teaching, Extension and other academic activities in the Department/ College.

P.R. GOVT.COLLEGE (A), KAKINADA

DEPARTMENT OF PHYSICS & ELECTRONICS

Meeting of Board of Studies in Physics is convened on 31st September 2022 at P.R. Govt. College (A), Kakinada, at 2.30 PM.

Venue: Staff Room, Department of Physics & Electronics, Dt: 31/10/2022, Monday – 2.30 PM.

The Principal Dr. B.V. Tirupanyam, Chairman U.V.B.B. Krishna Prasad, University Nominee, Dr. P. Paul Diwakar, Lecturer in Physics/Electronics, Govt. Degree College, Kaikaluru, Industrialist P.Suresh kumar, JVS Technologies, Kakinada, Subject Experts Dr. K. Jyothi, Principal, Government College, Nidadavole, Dr. M.V.K. Mehar, local Subject expert, Principal, Government college, Perumallapuram all the faculty members of Physics & Electronics Department, student alumni and students attended the meeting.

Agenda (To discuss and approve):

1. BOS
2. Approve Syllabus for 1st & 2nd years
3. Change of Choice percentage in the 1st & 2nd years examinations
4. Syllabi and Blue Print for I & II years
5. Split up for Continuous Comprehensive Evaluation (CCE)
6. Conduct of Two mid semester examinations & Pre final examinations.
7. Conduct of Practical examinations at each semester end.
8. Blue print for Practical examinations.
9. Panel of Question Paper Setters and Examiners.
10. Action plan for the ensuing academic year
11. Any other proposal with the permission of the Chair
12. Training for NET/SET/GATE/TIFR/JEST.

RESOLUTIONS BOARD OF STUDIES MEETING OF M.Sc. Physics

31st October 2022

The Board of Studies meeting was convened by the Physics & Electronics Department on 31-10-20222 at 2.30 pm under the chairmanship of U.V.B.B. Krishna Prasad, In-charge of the department. Dr. P. Paul Divakar, University Nominee, Subject Experts Dr. K. Jyothi, Principal, Government College, Nidadavole, Dr. M.V.K. Mehar, Principal, Government college, Perumallapuram and all members of the faculty of Physics & Electronics and student representatives attended the meeting. The following agenda items are discussed and resolutions are made

1. It is resolved to conduct BOS for this year and also resolved to serve the BOS documents to all the Nominees and Members of BOS well in advance for their observations and recommendations.
2. It is resolved to no change in the choice of percentage existing 48% in the semester end examinations for I & II year students.
3. It is resolved upload soft copy of notes, lab manuals and ppt of all semesters on college website for easy access of students.
4. It is resolved to grant extra credits to the following activities 1) MOOC Courses 2) NCC 3) Sports 4) NSS 5) JKC 6) Community Service 7) Cultural Activities 8) COP/Add on Course 9) Support services as per the guidance of office of COE.
5. It is resolved to approve the Syllabi, Question Bank and Blue print for I & II years.
6. It is resolved to split up of Continuous Comprehensive Evaluation For I & II year CCE – 15 Marks [ICT based Seminar / Assignment, -- 5 M, Comprehensive viva – 5M]
7. It is resolved to conduct the two theoretical mid semester examinations for I & II year students.
8. It is resolved to conduct one prefinal examination for I & II year students.
9. It is resolved to conduct of semester end practical exams with internal examiners for odd semesters i.e., for I & III semesters.
10. It is resolved to conduct of semester end practical exams with internal examiners & external examiners for even semesters i.e., for II & IV semesters.
11. It is resolved to approve blue print for Practical examination exams for all I & II years at the end of each semester.
12. It is resolved to approve blue print for internal exams for all I & II years at the end of each semester.
13. It is resolved to approve Panel of Question Paper Setters and Examiners.
14. It is resolved to approve Department Action Plan for the academic year 2022 - 23.
15. It is resolved to send Advanced Learners for Summer Research Project Training so as to gain Research Orientation.
16. It is resolved to submit the copy of BOS to the BOS Chairman for any further modifications / alterations

P.R.Government College (Autonomous), Kakinada

DEPARTMENT OF PHYSICS

Board of Studies Meeting 2022-23

Action Taken Report

The Department of Physics conducted the BOS meeting for the academic year 2021-22 on 12.11.2021 in the Department of Physics. All the activities according to the plan of action were successfully completed in the proposed time line. By taking the valuable recommendations of the members for enhancement of knowledge and to enrich the skills of the students, the department took initiatives and implemented various innovative steps viz.

- International conference was organized on 7.1.2022 on "New Forays Of Luminescent Advanced Materials & Phosphors in Multi Disciplinary Technologies" (Lamp – 2022)
- A guest lecture was conducted by scientists of BARC on "Nuclear Energy and its Applications, Career opportunities in BARC" on 17.302022
- A field visit was conducted to Command & Communication Centre, Smart City, Kakinada on 13th July 2022.
- Many electronic kits which were not in working condition were replaced by bread boards and electronic components.
- Started an add on certificate course "Applications of Solar Cells in Home Energy Systems" in Sem IV @30 hrs. for 2 credits having 5units@ 2 theory hrs. per week and one Study Project at the end of the course.
- Started a skill enhancement certificate course "Soldering and Desoldering of Components" in Sem IV @30 hrs. for 2 credits having 5units@ 2 theory hrs. per week and one Study Project at the end of the course
- Started "Centre for Innovation and Incubation Centre" for innovative projects on the platform of ' Atal Tinkering Labs'
- Installation of "Solar Tree" in before the Physics Block is in process

PG BOS CERTIFICATION

MSc., PHYSICS

P. R. GOVERNMENT COLLEGE (A), KAKINADA
Department of Physics & Electronics

This is to certify that the proposed agenda of board of studies meeting held in Department of Physics & Electronics on31 -10-2022, for the Academic Year 2022-23 have been discussed and approved by the board members unanimously. The valuable suggestions have been adopted for effective implementation of Curricular/Co-curricular and Research activities for the academic year 2022-23.

Members of Board of Studies			Signatures of members
1	U.V.B.B. Krishna Prasad	Chair person	
2	Dr. P. Paul Diwakar	University nominee, Lecturer in Physics, YVNR Govt. College, Kaikaluru	
3	Dr. K. Jyothi	Subject Expert;Principal; SVRKGDC(M), Nidadavolu	Jyothi.K 31/10/2022
4	Dr M V K Mehar	Subject Expert;Principal; GDC , Perumallapuram	
5	Sri P Suresh Kumar	Representative from Industry, JVS Technologies, kkd	
6	Dr. K. Nanda gopal	Student Alumni Member	
7	M Surekha	Member	
8	Dr. K. Jaya Dev	Member	
9	G Sridevi	Member	

10	A Padmavathi	Member	A. Padma
11	Dr.S.V.G.V.A.Prasad	Member	S.V.G.V.A.Prasad
12	P. Himakar	Member	P. Himakar
13	B. Srikanth	Member	B. Srikanth
14	K.Durgarao	Member	K. Durgarao
15	P.Veerendra	Member	P. Veerendra
16	D.Sravani	Member	D. Sravani
17	Y Sneha Latha	Student I M.Sc	Y. Snehalatha
18	R.V.G.S Sravani	Student I M.Sc	R.V.G.S. Sravani

P.R.Govt.College(A):Kakinada

DEPARTMENT OF PHYSICS

Course Structure for M.Sc physics

(With effect from 2021-22 admitted batch)

M.Sc Physics-I semester

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
PHY-101	Classical Mechanics	4	1		5	75	25	100	4
PHY-102	Atomic and molecular physics	4	1		5	75	25	100	4
PHY-103	Mathematical methods of physics	4	1		5	75	25	100	4
PHY-104	Electronic Devices & circuits	4	1		5	75	25	100	4
PHY-105	Electronics Lab- I			6	6	100	0	100	4
PHY-106	Modern Physics Lab-I			6	6	100	0	100	4
	Total	16	4	12	32	500	100	600	24

M.Sc Physics-II semester

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
PHY-201	Statistical Mechanics	4	1		5	75	25	100	4
PHY-202	Electrodynamics	4	1		5	75	25	100	4
PHY-203	Numerical methods & programming with C	4	1		5	75	25	100	4
PHY-204	Nuclear & particle physics	4	1		5	75	25	100	4
PHY-205	Electronics Lab-II			6	6	100	0	100	4
PHY-206	Modern Physics Lab-II			6	6	100	0	100	4
	Total	16	4	12	32	500	100	600	24

M.Sc Physics-III semester

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
PHY-301	Introductory quantum mechanics	4	1		5	75	25	100	4
PHY-302	Solid State Physics	4	1		5	75	25	100	4
PHY-303	Lasers & Non-linear optics	4	1		5	75	25	100	4
PHY-304	Digital Electronics &Microprocessors	4	1		5	75	25	100	4
PHY-305	Digital Electronics Lab			6	6	100	0	100	4
PHY-306	Solid State Physics Lab			6	6	100	0	100	4
	Total	16	4	12	32	500	100	600	24

M.Sc Physics-IV semester

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
PHY-401	Advanced Quantum Mechanics	4	1		5	75	25	100	4
PHY-402	Properties & Characterization of Materials	4	1		5	75	25	100	4
PHY-403	Communication electronics	4	1		5	75	25	100	4
PHY-404	Antenna theory & Radio Wave Propagation	4	1		5	75	25	100	4
PHY-405	Microprocessor Lab			6	6	100	0	100	4
PHY-406	Communication Electronics Lab			6	6	100	0	100	4
PHY-407	Comprehensive Viva					100	0	100	4
	Total	16	4	12	32	600	100	700	28

L: lecture Hours, T-Tutorial Hours, P-Practical Hours

P.R. Government College (A), Kakinada

Blue print for Semester End Theory Examination

M.Sc., Physics

(W.e.f. 2021-22 Admitted batch)

S.No	Evaluation			Total marks
I	**Theory (for I to IV semesters)**			
	Internal assessment Two mid-exams average Seminar / Assignment Comprehensive viva	15 5 5	25	100
	Semester end examination		75	
II	**Practical/Lab(for I to IV semesters)**			
	Semester practical end examination			100
III	Comprehensive viva (only for IV Sem)			100

Scheme of Examination at the end of each semester:

Theory pass percentage (Minimum) - 40%
Practical pass percentage (Minimum) - 50%

P.R. Government College (A), Kakinada

Blue print for Semester End Theory Examination

For I Year (Sem I & Sem II) and II Year (Sem III & Sem IV) Papers

S. No.	Type of question	No. of Questions Given			No. of Questions to be answered		
		No. of Questions	allotted To each	Total marks	No. of Questions	Marks allotted To each question	Total marks
1	Section – A Essay question	8 (2 questions from each unit)	15	120	4 (1 from each unit)	15	60
2	Section – B Short answer Question	8 (2 questions from each unit)	3	24	5	3	15
TOTAL				**144**			**75**

Percentage of Choice given $= \frac{144-75}{144} \; x \; 100$

$= \frac{69}{144} \; x \; 100 \qquad = 48\ \%$

P.R. Government College (A), Kakinada

Blue Print for Internal Theory Examination

For I Year (Sem I & sem II) and II Year (Sem III & sem IV) Papers

S. No.	Type of question	No. of Questions Given			No. of Questions to be answered		
		No. of Questions	Marks allotted To each question	Total marks	No. of Questions	Marks allotted To each question	Total marks
1	**Section – A** Essay question	3	10	30	2	10	20
2	**Section – B** Short answer questions	3	5	15	2	5	10
TOTAL				**45**			**30**

Percentage of Choice given $= \frac{45-30}{45} \; x \; 100$

$= \frac{15}{45} \; x \; 100 \qquad = 33\ \%$

The total of two internals is reduced to 15 marks and the other 10 marks allocated as follows

Seminar / Assignment = 5 marks

Comprehensive viva: = 5 marks

Total = 10 marks

Blue print for Semester End Practical examination

For I &II Year
Practical Paper

Scheme of Valuation for Practicals

Time: 3 hrs **Max. Marks: 100**

1. Formulae & Explanation	-	10 Marks
2. Tabular form + graph + circuit diagram	-	15 Marks
3. Observations	-	20 Marks
4. Calculation, graph, precaution and results	-	25 Marks
5. Viva voice	-	20 Marks
6. Record	-	10 Marks

Note: Minimum of 5 experiments to be done and recorded.

PROGRAM OUTCOMES

- Students will be trained to pursue higher studies and able to clear NET/GATE/ SET entrance exams
- Students would learn the physics concepts in depth and become master in particular area of physics.
- Students will learn analytical and integrative problem-solving approaches
- Students will have practical experience of Physics concepts, thereby can design application-oriented equipment.
- Students would develop industrial oriented skills
- Students can pursue research related to area of the physics

P.R. GOVERNMENT COLLEGE (A), KAKINADA

DEPARTMENT OF PHYSICS

ADDITIONS IN THE I YEAR SEM-I

S.NO	SUBJECT	NAME OF THE MODULE	TOPICS ADDED	JUSTIFICATION
1.	CLASSICAL MECHANICS	MODULE-4	Solving time period of small oscillations	Useful for CSIR NET,GATE

Percentage of Addition = 10 %

DELETIONS IN THE I YEAR SEM-I

S.NO	SUBJECT	NAME OF THE MODULE	DELETED TOPICS	JUSTIFICATION
1.	CLASSICAL MECHANICS	MODULE-1	Energy function and the conservation of Energy	Topic covered at GRADUATION level
		MODULE-3	Hamilton – Jacobi equation for Hamilton's characteristic function	No further scope
		MODULE-4	Rate of change of a vector	No further scope

Percentage of Deletions=15%

S.NO	SUBJECT	NAME OF THE MODULE	DELETED TOPICS	JUSTIFICATION
1.	ATOMIC & MOLECULAR PHYSICS	MODULE-4	Rotational spectra and the effect of isotopic substitution	

Percentage of Deletions=10%

S.NO	SUBJECT	NAME OF THE MODULE	DELETED TOPICS	JUSTIFICATION
1.	MATHEMATICAL METHODS OF PHYSICS	MODULE-1	Complex differentiation,multiply connected region-problems	

Percentage of Deletions=10%

DELETIONS IN THE II YEAR SEM-III

S.NO	SUBJECT	NAME OF THE MODULE	DELETED TOPICS	JUSTIFICATION
1.	SOLID STATE PHYSICS	MODULE-1	indexing pattern of cubic crystals and non-cubic crystals (analytical methods).	

Percentage of Deletions=10%

S.NO	SUBJECT	NAME OF THE MODULE	DELETED TOPICS	JUSTIFICATION
1.	LASERS AND NON-LINEAR OPTICS	MODULE-3	Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment	No further scope

Percentage of Deletions=15%

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (I Sem)			
Course Code PHY 101	**CLASSICAL MECHANICS**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:	Newton laws, Mechanics of a particle, work-energy theorem	4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Students would learn about Lagrangian and Hamiltonian problems and apply them to specific problems which are not soluble by Newtonian mechanics.
CO2	Students would learn about central force problems Keppler laws, Rutherford's scattering problem and principle of least action in Hamiltonian dynamics.
CO3	Students would learn about canonical transformations, Lagrange and Poisson brackets. They also learn about Hamiltonian-Jacobi formalism and a few applications.
CO4	Students would learn about rigid body dynamics and relativistic mechanics formulation and four vector notation.

MODULE-I: Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation **6 Hrs** .

Hamilton's principle, some techniques of the calculus of variations. .Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties. **5 Hrs.**

MODULE-II: Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field.. **7Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action. **6 Hrs**

MODULE-III: Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations. **5Hrs**

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, . Action – angle variables in systems of one degree of freedom. . 8 **Hrs.**

MODULE-IV: Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations,, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body **6 Hrs**

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule, ***solving Time period and frequency for small oscillations.*** **6 Hrs**

TEXT BOOKS : CLASSICAL MECHANICS-J.C UPADHAYA
Classical Mechanics H.Goldstein (Addison-Wleley, 1st & 2nd ed)

REFERENCE BOOKS: Classical Mechanics Aruldas

WEB LINKS

1. https://drive.google.com/file/d/1JAm4fmBiSj0568Oph8aqZZqnNZKuU_hr/view?usp=sharing
2. **https://drive.google.com/file/d/144KrE6oAJcr-mK9DqC1EwGYO74610S9U/view?usp=sharing**

DEPARTMENT OF PHYSICS

P.R.Govt.College(A)

M.Sc. Physics

I Semester

(w.e.f 2021-23 batch)

CLASSICAL MECHANICS

Time: 3 Hrs. **Max.Marks:75.**

SECTION –A.

Answer ALL Questions. **4 x 15 = 60M**

1. A) State D'Alembert's principle and derive Lagrange's equation of motion using it.

OR

B) .What are Constraints and explain different types of constraints.

C). Write applications of Lagranges equation.

2. A) Derive the Rutherford's formula for the scattering of a charged particle from scattering center.

OR

B) Write the differential equation of an orbit.

C) State and prove Bertrand's Theorem.

3. A) Derive Hamiltonian –Jacobi equation and obtain solution for Harmonic Oscillator using Hamiltonian – Jacobi equation

. OR

B) What are canonical Transformations and calculate the four sets of transformations using generating functions.

4. A) Derive Euler's equation of motion for a rigid body with one point fixed under finite forces.

OR

B) Derive Eigen values of Inertia tensor.

C) Discuss about the free vibrations of a linear triatomic molecule.

SECTION –B

Answer ANY five Questions. **3x 5 = 15M**

5. What are Constraints and mention types.
6. Obtain the equation of a simple pendulum by using Lagrangian method
7. Write differential equation of orbit.
8. State Principle of Least action.
9. What are Poissons brackets and mention their properties.
10. Write about Infinitesimal contact transformations.
11. What is Coriolis force?
12. State and explain Euler's Theorem

	P.R. Government College (A), Kakinada	**Program & Semester** I M.Sc. (I Sem)			
Course Code PHY 102	**ATOMIC AND MOLECULAR PHYSICS.**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About One electron and many electron atoms and interaction of electrons in those systems, L-S, J-J coupling schemes and understand fine structure, hyperfine structure of single electron atoms and spectral terms arising due to many electron interactions.
CO2	About the behavior of atoms in external electric and magnetic fields and the effect of external fields on the spectral terms of atoms.
CO3	About rotational, vibrational, electronic spectroscopies of molecules and rotational vibrational spectrum of molecules and applicability and consequences of Frank- Condon principle.
CO4	About the group theoretical approach for studying molecular symmetry and possible spectral transitions. They also learn about various spectroscopic techniques and physical principle behind them.

:

MODULE-I **12 Hrs**

ONE ELECTRON ATOMS : Quantum numbers, Term values . Relation between Magnetic dipole moment and angular momentum of an orbiting electron. Stern–Gerlach experiment and electron spin.Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only. Selection rules. Fine structure of Balmer series of

Hydrogen and Fowler series of ionized Helium. Hyperfine structure of H_α line of hydrogen (I = ½).

ONE VALENCE ELECTRON ATOMS: Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits) and core polarization (non-penetrating orbits) by nl electrons. Term values and fine structure of chief spectral series of sodium. Intensity rules and application to doublets of sodium. Hyperfine structure of ^2P-^2S of sodium (I= 3/2).

MODULE-II **10 Hrs**

MANY ELECTRON ATOMS : Indistinguishable particles, bosons, fermions. Pauli's principle. Ground states. LS coupling and Hund's rules based on Residual coulombic interaction and spin-orbit interaction. Lande's interval rule. Equivalent and non-equivalent electrons. Spectral terms in LS and JJ coupling (ss,s^2 ,pp,p^2 configurations). Exchange force and Spectral series of Helium.

MODULE- III **8 Hrs**

ATOMS IN EXTERNAL MAGNETIC FIELD: Normal and Anomalous Zeeman Effects, Experimental study of Zeeman effect, Explanation of Normal and Anomalous Zeeman Effects, Quantum theory of Zeeman and Paschen-Back effects and its applications, Transition from weak to strong field, Examples of Zeeman effect in some transitions

ATOMS IN EXTERNAL ELECTRIC FIELD: Linear stark pattern of $H\alpha$ line of hydrogen, weak field and strong field Stark effects in Hydrogen, Quadratic stark pattern of D_1 and D_2 lines of Sodium.

MODULE-IV **20Hrs**

DIATOMIC MOLECULES: Molecular quantum numbers. Bonding and anti-bonding orbitals from LCAO's. Explanation of bond order for N_2 and O_2 and their ions. . Effect of nuclear spin functions on Raman rotation spectra of H_2 (Fermion) and D_2 (Boson). Vibrating rotator. Spectrum. Combination relations and evaluation of rotational constants (infrared and Raman). Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle). Sequences and progressions. Deslandre's table and vibrational constants.

BOOKS :

1. Atomic and Molecular Spectra - Rajkumar
2. Fundamentals of Molecular Spectroscopy - C.N.Banwell.
3. Group Theory - K.V.Raman.
4. Introduction to Atomic Spectra - H.E.White.

P.R.Govt.College(A): Kakinada

DEPARTMENT OF PHYSICS

I SEMETER

M.Sc PHYSICS

(Effective from 2021-23 Admitted Batch)

PHY102: ATOMIC AND MOLECULAR PHYSICS

MODEL QUESTION PAPER

Time: 3 Hrs Max.Marks:75

Answer ALL Questions **4 × 15M = 60 M**

1. a) Describe the Stern Gerlach Experiment and Evidence Spin of an Electron.
   b) Explain the Quantum Number Associated With an Electron of an Atom.

   (Or)

   c) Explain the Spin Orbit Interaction and Dependence of Energy on J Values.

   d) Explain the fine Structure of chief spectral series of sodium.

2. a) What Is Ls Coupling? Deduce The Various Interaction Energy Terms For L-S Coupling.
   b) Explain the Hund's rule based on residual coulombic interaction.

   (Or)

   c) What is Exchange force? Explain the Spectral Series of Helium.
   d) Explain the Spectral term of L-S Coupling & J-J Coupling with 4p, 4d.

3. a) What is Zeemann Effect and Explain the Quantum Theory of Normal Zeemann Effect.
   b) Explain the Weak Field and Strong Field Stark Effect in Hydrogen.

   (Or)

   c) Explain the Quantum theory of Paschen Back Effect.

   d) Explain the Linear Stark Pattern of H_α Line of Hydrogen.

4. a) Explain the Bonding and the Anti Bonding Orbital's from the Linear Combination of Atomic Orbital's.
   b) Explain Theory of Vibrating Rotator.

   (Or)

   c) Discuss the Effect of Nuclear Spin Function on Raman Rotation Spectrum of Hydrogen

   d) Explain the Bond Order of O_2 and N_2.

SECTION-B

ANSWERS ANY FIVE QUESTIONS **5X3M=15M**

5. Explain the Hyperfine Structure of H_α line (I =1/2).
6. Explain the Fine Structure of the Balmer Series.
7. What are Bosons and Fermions?
8. State and Explain Pauli's Exclusive Principle?
9. Draw the Anomalous Zeemann Effect $^2P_{1/2}$ -> $^2S_{1/2}$ and $^2P_{3/2}$ -> $^2S_{1/2}$ Transition for Sodium.
10. What is Paschen Back Effect?
11. State and Explain the Franck Condon Principle?
12. What are the types of Molecular Spectra?

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (I Sem)			
Course Code PHY 103	**Mathematical Methods of Physics**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About Laplace and Fourier transformations and how to apply them to problems in electronic and electrical circuit analysis and quantum mechanics.
CO2	About vector spaces, matrices and tensors and their applications in quantum mechanics Hilbert spaces, Schmidt orthogonalization, matrix diagonalization and tensor analysis.
CO3	About complex variables and apply them to evaluate complex integrations and residues.
CO4	About special functions, beta-gamma functions, partial differential equations and how to apply them to one dimensional problems in quantum mechanics and scattering problems.

MODULE I : Complex Variables

15 Hrs

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, , complex integration –Cauchy's integral theorem- Cauchy's integral formulae-, Infinite series-Taylor's theorem- Laurrent's theorem-Problems, Cauchy's Residue theorem- evaluation of definite integrals-problems.

Text Book:1. Mathematical Methods of Physics-G.Arfken,Academic Press

2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi

3.Complex Variables (Schaum's out line series) MurrayR.Spiegel
Ref Book: Mathematical Methods B.D.Gupta

MODULE II : Beta , Gamma functions &Special functions
10 Hrs

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations-Rodrigue's formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

Text Book: **1.**Mathematical Methods of Physics-G.Arfken,Academic Press
2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi
3. Mathematical Physics B S Rajput
Ref book : Special Finctions .M.D.Raisinghania

MODULE III : Laplace Transforms
15 Hrs

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations

Text Book: **1.**Mathematical Methods of Physics-G.Arfken,Academic Press
2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi
3. Laplace n Fourier Transforms Goyal & Gupta,
Ref books: Integral Transforms M.D.Raisinghanna
Integral Transforms Goyal & Gupta
Mathematical Physics B S Rajput

MODULE IV: Fourier series, Fourier Transforms
15 Hrs

Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave

Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

Text Book: **1.**Mathematical Methods of Physics-G.Arfken,Academic Press
2.Mathematical Physics-Satya Prakash, Sultan Chand & co,New Delhi
3. Laplace n Fourier Transforms Goyal & Gupta,
Ref books: Integral Transforms M.D.Raisinghanna

DEPARTMENT OF PHYSICS
I SEMESTER
M.Sc. PHYSICS
(Effective from 2021-2023 admitted batch)
PHY103: MATHEMATICAL METHODS OF PHYSICS.
MODEL QUESTION PAPER

Time: 3 Hrs. **Max.Marks:75**

SECTION –A.

SECTION-A

Answer ALL Questions **4 × 15M = 60 M**

1. a) State and prove Cauchy's integral theorem

   b) Evaluate $\oint_c \frac{\sin \pi z^2 + \cos \pi z^2}{(Z-1)(Z-2)}\, dz$ |Z| = 3

   (Or)

   c) State and prove Cauchy-Riemann Equations.

   d) Evaluate the following Integral using Residual theorem $\int_c \frac{1+Z}{Z(2-Z)} dz$ where c is the circle |z| = 1.

2. a) Define beta and gamma functions and obtain the relation between them.

   b) Obtain $L_3(x)$, & $L_{34}(x)$ from Laguerre Rodrigue's formula.

   (Or)

   c) Obtain $L_3(x)$, & $L_{34}(x)$ from Laguerre Rodrigue's formula.

   d) Evaluate $\int_0^\infty e^{-x2}\, dx$.

3. a) Define Laplace transform. State and prove first and second shifting properties of Laplace transform.

   b) Evaluate $L^{-1}\left[\frac{1}{(S+1)(s2+1)}\right]$

   (Or)

   c) Define Laplace transform. State and prove Linear property and Change of scale property of Laplace transform.

   d) Evaluate $L^{-1}\left[\frac{6s2+22S+8}{(s3+6s2+11S+6)}\right]$

4. a) Define Finite and Infinite Transforms and obtain the two properties of Fourier transform.

   b) Find Fourier cosine transform of e^{-x2}

(Or)

c) State and Prove Fourier integral Theorem.

d) Find Fourier sine and cosine transform of x^{n-1}

SECTION-B

ANSWERS ANY FIVE QUESTIONS **5X3M=15M**

5. Show that f (z) = |z| is not analytical function.

6. Find the residue of f(z) = $\frac{z2}{z2+a2} at\ z = a$

7. Obtain $P_0(x)$ & $P_1(x)$ from Legendre's Rodrigue's formula

8. Show that $\beta\ (m,n) = \beta\ (n,m)$

9. Find the Laplace transform of f(t) = e^{at} and f(t) = e^{-at}.

10. Evaluate $L^{-1}[\frac{1}{s3(s2+1)}]$

11. Explain change of scale property of Fourier transform.

12. Find the Fourier series expansion for f(x), if f(x) = $\begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (I Sem)			
Course Code PHY 104	ELECTRONIC DEVICES AND CIRCUITS				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the basic operation of P-N Junction diode and various applications of the same. They also learn about Zener diode and it's applications.
CO2	About various configurations of BJT and its biasing techniques. They also learn about the usage of BJT as a power amplifier and development of h-parameters for various BJT Configurations.
CO3	About the FET, UJT, SCR and other two terminal special electronic devices. They also learn about a few applications of them.
CO4	About the basics of architecture of operational amplifiers and applications of them. They also learn about the IC based voltage regulators.

MODULE-I

SEMICONDUCTOR DEVICES: 10 Hrs.

Tunnel diode, photo diode, solar cell, LED, APD, PIN Diode, Schottky Barrier Diode, Silicon controlled Rectifier, Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET),

CMOS (Principle, working and Applications for all devices)

MODULE-II

MICROWAVE DEVICES: 15 Hrs.

Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode,

Magnetron,CFA,TWT, BWO, IMPATT, TRAPATT (Principle, working and Applications for all devices)

MODULE-III

OPERATIONAL AMPLIFIERS : 10 Hrs.

The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture –

differential stage, gain stage, DC level shifting, output stage, offset voltages and currents .

Operational Amplifier parameters- input offset voltage, input bias current, Common Mode Rejection Ratio,

Slew Rate

MODULE-IV 15 Hrs.

OP- AMP APPLICATIONS:

Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter

Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger

Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage

regulators.

TEXT BOOKS:

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy(PHI)

REFERENCE BOOKS:

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)

P.R.Govt.College(A):Kakinada
DEPARTMENT OF PHYSICS
I SEMESTER
M.Sc. PHYSICS
(Effective from 2021-2023 admitted batch)

PHY104 :ELECTRONIC DEVICES AND CIRCUITS
MODEL QUESTION PAPER

Time : 3 Hrs **Max. Marks:75**

SECTION - A

Answer ALL Questions **4 x 15 = 60**

1. a) Describe the working of a FET and explain its Characteristics. 10
   b) Explain briefly the small signal model of FET. 5

OR

   c) Give the construction and Characteristics of an SCR and explain its working. 10
   d) Show how an SCR can be used to control power in a circuit. 5
2. a) Describe the working of Reflex Klystron and explain its Characteristics 10
   b) Explain briefly the working of diac 5

OR

   c) Describe the working of Magnetron and explain its Characteristics 10
   d) Explain why magnetron is called as CFA 5
3. a) What are the important parameters of an operational amplifier. 5
   b) Describe the method of their measurement. 10

OR

   c) Explain the terms differential gain and DC level shifting of an op-amp 10
   d) What are the characteristics of an ideal op-amp 5
4. a) Draw the circuit diagram of a V C O and discuss its operation 10
   b) Mention some its applications 5

OR

   c) Describe with necessary theory, the working of a wein-bridge oscillator using op-amp 10
   d) How do you account for its frequency stability? 5

S E C T I O N - B

Answer any F I V E Questions **5 x 3 = 15 Marks**

5. Explain the principle and working of solar cells.
6. Explain the characteristics of a varactor diode.
7. Explain the working of an Astable Multivibrator using 555.
8. Explain the principle of working of a series voltage regulator.
9. Explain what is meant by negative resistance in a tunnel diode.
10. Explain how an UJT can be used as a relaxation oscillator.
11. Explain the working of op-amp as voltage to current converter
12. Explain the working of a Schmitt trigger.

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (I Sem)			
Course Code PHY 105	Electronics Lab- I				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	4

1. FET Characteristics

2 . UJT Characteristics

3. OP-AMP as Inverting Amplifier

4. OP-AMP as Non- Inverting Amplifier

5.OP-AMP as Summing Amplifier

6.OP-AMP as Differentiator

7.OP-AMP as Integrator

8.Wein-Bridge Oscillator

9. Phase shift Oscillator (BC 147)

10. Astable Multivibrator (BF 194)

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (I Sem)			
Course Code PHY 106	Modern Physics Lab-I				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	4

1. Atomic Spectrum of Zinc.
   a) Verification of Lande's interval rule
   b) Study of relative intensities
2. Grating spectrometer
   a)Wavelengths of Hg spectrum,
   b) Wavelength of Balmer series, Rydgberg constant
3. Reciprocal dispersion curve
4. Application of Point Groups.
   a)Identification of symmetry operations in H_2O, BH_3 , NH_3 and H_2CO
   b) Reducible representations and Vibrational modes of H_2O.
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor.(Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
   a)conversion of given wavelengths to wavenumbers and assignment of (v', v'')
   b)Deslandres' table and Vibrational constants.

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (II Sem)			
Course Code PHY 201	STATISTICAL MECHANICS				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the basics concepts of ensembles, and calculation of various thermodynamic quantities in those ensembles. They also learn about thermodynamic equivalence of various ensembles.
CO2	About the application of the concepts of ensembles to various one dimensional problems and thermodynamic properties of molecules.
CO3	About some simple applications of statistical mechanics, get through with the validity of the classical approximation and also learns about the different theories about the specific heat of the solids.
CO4	About the quantum statistics and applications of them to standard problems like Black body radiation, concepts of Formulation of the statistical problem, B-E condensation, thermionic emission and white dwarf stars

MODULE-I : Basic Methods and Results of Statistical Mechanics: **13 Hrs**

Specification of the state of a system, phase space and quantum states, Liouvilles theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities, Isolated systems(Microcanonical ensemble). Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean

energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble . Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

MODULE-II : Simple Applications of Statistical Mechanics: **12 Hrs**

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

MODULE-III: Quantum Statistics: **15 Hrs**

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics,Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

MODULE – IV: RELATIVISTIC MECHANICS 20 Hrs

Introduction: Postulates of relativistic mechanics. Minkowski Space, Geometrical representation of

Lorentz transformation of space and time. Application to Lorentz transformation. Geometrical representation of Simultaneity, length-contraction and time dilation. Space like and time like intervals. Relativistic classification of particle, Basic ideas of general theory of relativity.

(Sathya Praksah)

Text Books

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3 .Statistical mechanics – Satya Prakash

P.R.Govt.College(A):Kakinada

DEPARTMENT OF PHYSICS

II SEMESTER

M.Sc.PHYSICS

(Effective from 2021-2023 admitted batch)

PHY201 :STATISTICAL MECHANICS.

MODEL QUESTION PAPER

Time : 3 Hrs. **Max. Marks:75**

Answer ALL Questions. 4 x 5 = 60.

1. a) State and prove the equipartition theorem.
   b) Calculate the specific heat at constant volume of an ideal gas with i degrees of freedom.

   OR

   c) Explain the concept of ensemble. Mention the different types and their properties.
   d) Derive an expression for the most probable distribution of energy among the various systems of a canonical ensemble.

2. a) Distinguish between classical, Bose – Einstein and Fermi Dirac Statistics.
   b) Obtain an expression for Fermi – Dirac distribution law.

   OR

   c)Derive the Planck formula for black body radiation using Bose-Einstein Statistics.
   d) Calculate the pressure ρ of the electromagnetic radiation in a cavity of volume ν.

3. a) Derive an expression for the specific heat of diatonic gases.
   b) Discuss how the results compare with experiments.

   OR

   c) Discuss in detail the Einstein's theory of specific heat of solids.
   d) Mention the salient features of the theory.

4. a) Derive the Expression for Lorentz Transformations.

   OR

   b) Explain Time Dilation as well as length Contract with Mathematical Analysis
   c) Briefly write general theory of relativity

SECTION - B

Answer any FIVE Questions **5 x 3 = 15 Marks.**

5. Explain the phenomena of thermionic emission.
6. Explain the Vander walls theory of liquid gas transition.
7. Calculate the average energy per particle of the Fermions at absolute Zero temperature.
8. Show that at low temperatures a diatomic gas behaves like a monoatomic gas.
9. Explain the ortho and para states of hydrogen.
10. State and prove Liouvellie's theorem.
11. Explain Gibbs paradox
12. Explain Relativistic classification of particle

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (II Sem)			
Course Code PHY 202	ELECTRO DYNAMICS				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the Poisson and Laplace equations And their solutions.
CO2	About the concepts of Ampere's law and Faraday's law. Students would learn about the Maxwell's equations and various gauge potentials.
CO3	About the charged particle dynamics in external electric, magnetic and both electric & magnetic fields.
CO4	About Lienard-Wiechert potentials, radiation due to moving and accelerated charges, Cherenkov radiation and the concept of plasma waves. Students would learn about the concepts of covariance and tensor notations for electromagnetic fields and Maxwell equations.

UNIT-I: Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems. 6Hrs
Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic induction,**4Hrs**

UNIT-II;
Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations.

Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge **6Hrs**

Charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogenous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields. **6Hrs**

UNIT-III: Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves **10Hrs**

UNIT-IV: Transformation of electromagnetic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field equations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields.
12 Hrs

Text books:

1. Classical Electrodynamics : - J.D. Jackson
2. Introduction to Electrodynamics : - D.R. Griffiths
3. .Electromagnetic Theory and Electrodynamics - Satyaprakash
4. Electrodynamics - KL Kakani

P.R. Govt. College(A): Kakinada

DEPARTMENT OF PHYSICS

II SEMESTER

M.Sc. PHYSICS

(Effective from 2021-2023 admitted batch)

PHY202: ELECTRODYNAMICS.

MODEL QUESTION PAPER)

1. A) State and prove Gauss Theorem.

   b) Derive Laplace's and Poisson's equations from Gauss law.

   OR

   b) Explain the method of separation of variables in spherical polar co-ordinates. Obtain potential outside a conducting sphere.

2. a) State Ampere's circuital law. Define magnetic vector potential and discuss its utility inmagnetostatics

   OR

   b) Write down Maxwell equations in differential and integral forms. Explain their physical significance.

3. a) What are Lienard–Wiechart potentials. Calculate the electric and magnetic field using thesepotentials.

   OR

   b) What are gauge transformations. Explain Coulomb and Lorentz gauges. Mention their importance.

4. a) Discuss the conditions for the existence of plasma. Discuss the motion of a chargedparticle in uniform electric and magnetic fields

   OR

b) Show that the Maxwell's electromagnetic field equations are invariant under the Lorentz transformation

PART B

Answer any FIVE Questions 5 x 5 = 25

5. Cherenkov radiation

6. Radiation damping

7. Displacement current

8. Electromagnetic field tensor

9. Faraday's law of electromagnetic induction

10. Electromagnetic scalar and vector potentials

11. Significance of retarded potentials

12. Maxwell's equations in terms of scalar and vector potentials.

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (II Sem)			
Course Code PHY 203	**NUMERICAL METHODS & C PROGRAMMING**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the theorems of solving linear equations
CO2	the knowledge of the methods of the numerical differentiation and integration
CO3	and understand the basic concepts of C PROGRAMMING
CO4	and grasp the C PROGRAMMING skill

MODULE- I: NUMERICAL TECHNIQUES

Solution of algebraic and transcendental equations: Bisection method, Method of false position and Newton- Raphson method. Principle of least squares – fitting of polynomials.

Interpolation: Finite differences (forward, backward and central difference), Newton's formula for Interpolation, Central difference Interpolation formula (Gauss's & Sterling formula), Lagrange's Interpolation formula, Inverse Interpolation. (Sastry)

MODULE-II: NUMERICAL DIFFERENTIATION & INTEGRATION

Differentiation: Cubic Spline Method, Maximum and Minimum values of a Tabulated function

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 Rule and 3/8 Rule. Solutions of linear systems- Direct methods: Matrix Inversion method, Gaussian Elimination method, Modification of Gaussian Elimination method (Gauss-Jordan Method). Iterative methods: Jacobi method, Gauss Seidel method. Numerical solutions of ordinary differential equations: Solution by Taylor's series, Picard's method of successive

approximations, Euler's method (Error estimates for the Euler's method, Modified Euler's method) and Range-Kutta method. (Das & Sastry)

MODULE- III: INTRODUCTION TO 'C' LANGUAGE

Character Set, C tokens, Key words and Identifiers, Constants and Variables, Data types, Declaration of variables. Operators and expressions: Arithmetic, Relational, Logical, Assignment, Increment and Decrement operators, Conditional, Bitwise and special operators. Precedence in evaluating arithmetic operators. Reading and writing a character. IF, IF-ELSE, Nesting IF-ELSE, ELSE IF ladder and GOTO statements, WHILE, DO,FOR loop statements. Simple programs

(Bal Guruswamy & Kanethkar)

MODULE- IV: PROGRAMMING IN C -LANGUAGE

Arrays: One- and Two-dimensional arrays, Declaring and initializing string variables. Reading strings from terminal and writing strings to screen. User defined functions: definition of functions, Return values and their types. Function calls and function declaration. Pointers: Declaring and initializing pointers, Accessing a variable through its pointer. C- Programming: Linear regression, Sorting of numbers, Calculation of standard deviation and matrix multiplication

(Bal Guruswamy & Kanethkar)

BOOKS FOR STUDY:

1. Numerical Methods. B.S. Gopal& S.N. Mittal
2. Numerical Methods. S. Sastry
3. Mathematical Physics. H.K. Das, S. Chand & Co.
4. Programming in ANSI C, E Bal Guruswamy, TMH New Delhi, 2004.

P.R. Govt. College(A): Kakinada

DEPARTMENT OF PHYSICS

II SEMESTER

M.Sc. PHYSICS

(Effective from 2021-2023 admitted batch)

PHY203: NUMERICAL METHODS & C-PROGRAMMING

MODEL QUESTION PAPER)

Time: 3 Hrs. **Marks :75**

SECTION – A

Answer all Questions 4 X 15 = 60.

1.(a). Find the root of the following equation using (i) Bisection Method and (ii) Newton-Raphson method as,correct the result up to 3 decimal places $x^3 - 3x-5=0$.

(OR)

(b) Find f (2) for the data f (0) = 1, f (1) = 3 and f (3) = 55. By using Newton's divided difference formula andLagrange's formula

2.(a) Solving a system of equations by the Gauss-Seidel method

$$4x_1 + x_2 - x_3 = 3$$
$$2x_1 + 7x_2 + x_3 = 19$$
$$x_1 - 3x_2 + 12x_3 = 31$$

(OR)

(b) 1 From the following table, find the area bounded by the curve and x axis from x=7.47 to x=7.52 using trapezoidal, Simpson 1/3, Simpson 3/8 rule.

x	7.47	7.48	7.49	7.50	7.51	7.52
f(x)	1.93	1.95	1.98	2.01	2.03	2.06

(c) **By using Simpson's rule with h=0.25 and** $\int_0^1 \frac{1}{1+x}$

3. (a) What is keyword? Write any five keywords and explain them.

(b) Distinguish between local and global variables.

(c) Write a program to compute roots of quadratic equation using switch-case statement.(OR)

(d) Write the precedence rules for arithmetic operators and give example.

(f) What are loops? Explain various loop statements with suitable example.

4. a) Explain the following concepts associated with functions: i) Function declaration ii) Functiondefinition iii) Function call.

b) Explain various parameter passing mechanisms.

(OR)

C) What is a Pointer? How is it initialized? What is the function of a pointer variable? What areits uses?

b) Explain the concept of pointers to structures with suitable example.

PART B

ANSWER ANY FIVE QUESTIONS **3*5=15M**

5. Explain Principle of least squares Technique.

6. Discuss about Gaussian Elimination method for solution of equations

7. write about Increment and Decrement operators in C language with their Syntax

8. Write the various Character Sets in C

9. How to Declaring and initializing string variables in C.

10. Briefly write Picard's method of successive approximations

11. Find the root of the following equation using Bisection Method correct the result up to 2 decimal places x^2 - 3x-3=0.

12. Draw the flow chart for calculation of Linear regression

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (II Sem)			
Course Code PHY 204	**NUCLEAR & PARTICLE PHYSICS**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About various short range forces and study the Deuteron problem to understand the properties of various inter-nuclear forces.
CO2	About various nuclear models and magic numbers. They also learn about α, β and γ decay mechanisms and the basic concepts of Mossbauer effect.
CO3	About nuclear reaction conservation laws, fission, fusion reactions and various nuclear radiation detectors.
CO4	About various particle accelerators, basic concepts of particle physics, CP CPT symmetries and quark model

MODULE -1

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry,domains of instability, mirror nuclei.

NUCLEAR FORCES: Simple theory of the deuteron, scattering cross-sections, qualitative discussion ofneutron- proton and proton- proton scattering, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces**. 15 hrs.**

MODULE - II

NUCLEAR MODELS. Liquid drop model: Weissacker's semi-empirical mass formula, Mass – parabolas. Nuclear shell model: Spin orbit interaction, magic numbers, prediction of angular momenta andparities for ground states, Collective model

NUCLEAR DECAY: Fermi's Theory of □ - decay, parity violation in □ -decay, detection and propertiesof neutrino. Energetics of gamma decay, selection rules, angular correlation, Mossbauer effect.

15 hrs.

MODULE – III

NUCLEAR REACTIONS: Types of reactions and conservation laws, the Q – equation, Optical model. **NUCLEAR ENERGY** Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, four factor formula for controlled fission, nuclear fusion, prospects of continued fusion energy.

DETECTING NUCLEAR RADIATION: Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, bubble chamber, magnetic spectrometers.

10 hrs.

MODULE - IV

ACCELERATORS: Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators,colliding beam accelerators**.**

ELEMENTARY PARTICLE PHYSICS: Particle interactions and families, conservation laws (energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number (Gellmann and Nishijima formula) and charm), Elementary ideas of CP and CPT invariance, Quarkmodel.

TEXT BOOKS: "Introductory Nuclear Physics" Kenneth S. Krane

Reference Books:

1. "Introduction to Nuclear Physics "H a r a l d A. Enge
2. "Concepts of Nuclear Physics " Bernard L. Cohen.
3. "Introduction to High Energy physics" D.H. Perkins

DEPARTMENT OF PHYSICS
II SEMESTER
M.Sc. PHYSICS
(Effective from 2021-2023 admitted batch)
PHY204: NUCLEAR & PARTICLE PHYSICS
MODEL QUESTION PAPER)

SECTION - A

Answer all Questions **4 X 15 = 60.**

1	a)	What is meant by nuclear spin and nuclear magnetic moment? How the magnetic moment is determined experimentally	5+5
	b)	Discuss one important method used to study the nuclear size	5
		OR	
	c)	What is a tensor force? Explain how it accounts for the observed quadrupole moment of deuteron	10
	d)	Briefly explain the characteristics of nuclear forces	5
2.	a)	Discuss the formulation of Weizacker's semi – empirical mass formula and obtain the condition for stable isotope	8+2
	b)	Briefly discuss the collective model of the nucleus.	5
		OR	
	c)	Give a brief account of Fermi's theory of β – decay.	10
	d)	Discuss two important selection rules in β – decay.	5
3.	a)	What are different types of nuclear reactions	8
	b)	Describe the Q- equation of a nuclear reaction. What information can you get from the Q- equation	5+2
		OR	
	c)	Discuss Bohr – Wheeler theory of nuclear fission and derive stability limit against spontaneous fission	10
	d)	Explain carbon – nitrogen cycle in nuclear fusion	5
4.	a)	With the help of a diagram explain the classification of elementary particles	5
	b)	Explain briefly various interactions among the elementary particles	10
		OR	
	c)	Discuss the conservation laws that explain the behavior of elementary particles	10
	d)	Briefly explain the charge conjugation	5

PART - B

Answer any Five Questions **5 x 3 = 15**

5. Explain the parity and symmetry of the nucleus
6. Briefly explain the nature of information that you can get from scattering experiments
7. Discuss what are Schmidt's limits of the nuclear magnetic moments
8. What are the selection rules in γ – decay
9. Discuss briefly about synchrotron
10. Explain the operation of colliding beam accelerators
11. Discuss briefly about Rutherford back scattering experiment
12. Briefly explain the quark model of the nucleus

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (II Sem)			
Course Code PHY 205	ELECTRONICS LAB-II				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	

LIST OF EXPERIMENTS

1. Active Low pass and High Pass filters (IC 741)
2. Twin -T filter (IC 741)
3. Logarithmic Amplifier (IC 741)
4. Wein Bridge Oscillator (IC 741)
5. Monostable multivibrator (IC 555)
6. Voltage Regulator (IC 723)
7. Phase Shift Oscillator (IC 741)
8. Astable multivibrator (IC 555)
9. Active band pass filter (IC 741)
10. Voltage controlled oscillator ((IC 741, IC 555)

	P.R. Government College (A), Kakinada	Program & Semester I M.Sc. (II Sem)			
Course Code PHY 206	**MODERN PHYSICS LAB-II**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	

1. Atomic Spectrum of Sodium.
   a) identification of sharp and diffuse doublets
   b) Doublet separation
   c) Assignment of principal quantum numbers
2. Raman Spectrum of Carbon Tetrachloride
   a) Raman shifts
   b) Fermi resonance
3. Vibrational analysis of AlO Green system.
   a) identification of sequences, assignment of vibrational quantum numbers,
   b) Deslandre's table and Vibrational constants.
4. Determination of Specific Charge of an electron by Thomson's Method.
5. Experiments with He- Ne laser.
   a) Polarization of laser light
   b) Divergence of laser beam and monochromaticity.
6. Band gap of a semiconductor (Four probe method).
7. Dielectric constant as a function of temperature and determination of Curie Temperature
8. Susceptibility of a substance Gouy's method
9. Dissociation energy of Iodine molecule from the given data.

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 301	INTRODUCTORY QUANTUM MECHANICS	II M.Sc. (III Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	The dual nature of matter, de Broglie hypothesis, Schrodinger wave equations and their applications.
CO2	The physical interpretation of various operators, Eigen values and Eigen functions.
CO3	Students will study the motion particle in one and three dimensions and that of linear harmonic oscillator.
CO4	Students will grasp the concepts of angular momenta (orbital and spin) and their Eigen value problems.

MODULE-I: The Conceptual aspect :Wave particle duality,Uncetainty principle, Principle of superposition - Wave packets – phase velocity and group velocity- Schrodinger Wave Equation - , wave function interpretation and admissibility conditions, probability current density, expectation value, Erhenfest theorem, stationary states.

8hrs

MODULE-II: Bracket notation, orthonormal functions, linear operators and their properties, - Hermitian operator, Schmidt orthogonalisation, Postulates of quantum mechanics, simultaneous measurability of observables, commutator algebra, equation of

motion of an operator (Schrodinger representation), Momentum representation- - Dirac delta function and properties. **12 hrs**.

MODULE-III: One dimensional problems - Particle in a potential well with (i) infinite walls, (ii) finite walls. Potential step, Potential Barrier. Linear Harmonic Oscillator (Schrodinger method). Free particle. Particle moving in a spherically symmetric potential, spherical harmonics, radial equation,. Eigen values and eigen functions of rigid rotator, hydrogen atom, hydrogenic orbitals, angular momentum operators, commutation relations, eigen values and eigen functions of L^2 , Lz, L+ and L- spin angular momentum, general angular momentum.. **15 hrs**.

MODULE-IV: Time- independent perturbation theory for **(i)** non degenerate systems and application to ground state of helium atom., effect of electric field on the ground state of hydrogen, spin orbit coupling ii) degenerate systems, application to linear stark effect in hydrogen.. Variation method and its application to helium atom., exchange energy and low lying excited states of helium atom. WKB method, barrier penetration.
15hrs.

Text Book : Quantum Mechanics – Nouredine Zettili
Quantum Mechanics R.D. RATNA RAJU

Reference Books :

1.Quantum Mechanics Aruldhas
2.Quantum Mechanics G. S. Chaddha
3. Quantum Mechanics B.H.Bransden and C.J.Joachain
4.Quantum Mechanics E. Merzbacher
5.Quantum Mechanics Richard Liboff

DEPARTMENT OF PHYSICS

I SEMESTER

M.Sc. PHYSICS

(Effective from 2020-2021 admitted batch)

PHY301: INTRODUCTORY QUANTUM MECHANICS

MODEL QUESTION PAPER

Time: 3 Hrs. **Max.Marks:75.**

SECTION –A.

Answer ALL Questions. 4 x 15 = 60.

1. a) Derive Schrodinger wave equation. Obtain an expression for Probability current density.

   b) What are stationary states? Show that for stationary states probability current density is constant in time.

OR

   c)State and prove Ehrenfest's theorem.

   .

2. a) Write about the Linear and Hermitian operators and mention the properties of Hermitian operator.

OR

   b) State the postulates of Quantum Mechanics.

3. a) Solve the Schrodinger equation for a linear harmonic oscillator and obtain eigen values.

OR

   b) Obtain Schrodinger equation for particle trapped in a infinite potential and obtain Eigen values.

4. a) Obtain the Ground state energy of Helium using Variation method.

OR

   b).Write the first order correction to Time Independent Perturbation theory.

SECTION-B

Answer any FIVE Questions **5 x 3= 15**

5. Explain wave and particle duality of microscopic particles.
6. State Heisenberg's uncertainty principle.
7. Bracket Notation..
8. .Dirac Delta function and Properties.
9. Find Eigen values of J^2 and J_z
10. Find the energy states of the one dimensional step barrier
11. WKB Approximation.
12. barrier penetration

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 302	**SOLID STATE PHYSICS**	II M.Sc. (III Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the crystal systems, two and three dimensional Bravais lattices and their examples- diffraction of x-rays through crystal planes
CO2	the lattice vibrations and their momentum along with density of states and band gap of the solids
CO3	the concept of classification of metals, insulators and semiconductors from band theory of solids
CO4	about the principle of superconductivity, properties, types of superconductors and their application

MODULE-I:

CRYSTAL STRUCTURE:

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two Dimensional lattice types, three Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE:

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical StructureFactor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

MODULE-II:
PHONONS AND LATTICE VIBRATIONS:
Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

FREE ELECTRON FERMI GAS:
Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields- Hall effect, Ratio of thermal to electrical conductivity.

MODULE-III:
THE BAND THEORY OF SOLIDS:
Nearly free electron model, Origin of the energy gap, The Block Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron-Approximate solution near a zone boundary, Number of orbitals in a band--metals and isolators. The distinction between metals, insulators and semiconductors

MODULE IV:
SUPERCONDUCTIVITY
Concept of zero resistance, Magnetic behavior, distinction between a perfect conductor and superconductor . Meissner effect, Isotope effect–specific heat behavior. Two-fluid model. Expression for entropy difference between normal and superconducting states. London's equations. Penetration depth. BCS theory. Josephson junctions–SQUIDS and its applications . Applications of superconductors. High T_C superconductors, Preparation, Properties.

TEXT BOOKS:

1.Introdcution to Solid State Physics, C.Kittel, 5^{th} edition,
2.Solid State Physics, A.J.DEKKER.

P.R.Govt.College(A): Kakinada
DEPARTMENT OF PHYSICS
III SEMESTER-M.Sc. PHYSICS
(Effective from 2020-2021 admitted batch)
PHY302: SOLID STATE PHYSICS.
MODEL QUESTION PAPER

Time: 3 Hrs. **Max.Marks:75.**

SECTION –A

Answer ALL Questions. 4 x 15 = 60.

1. a) What are the different fundamental types of 3 dimensional lattices
   b) Explain the index system for crystal planes.
   c) In a tetragonal lattice a=b=1/4nm and c=1/7nm. Deduce the lattice spacing between (l l l) planes.

OR

   d) What is Bragg's law.
   e) Describe in detail experimental diffraction methods.

2. a) Obtain the dispersion relation for a monoatomic lattice considering interactions among nearest neighbour planes.
   b) Explain the first Brillouin zone and group velocity for the elastic waves. What is long wave length limit in the continuum theory

OR

   c) Derive an expression for electron gas in three dimensions.
   d) Deduce expressions for fermi energy, density of orbitals and electron velocity at the Fermi surface

3. a) State Bloch's theorem
   b) Obtain the condition for energy states of electrons moving in a periodic Kronig – Penny potential.
   c) State the interesting conclusions from the above model.

OR

   d) Distinguish between reduced and periodic Zone schemes for by construction of Fermi surfaces. Describe the construction of Fermi surfaces considering the analysis of a square lattice.
   e) Show that the slope of bands at Zone boundaries is Zero

4. a) Discuss BCS theory of SuperConductors
   b) Explain Josephson junctions of Super Conductors

OR

   c) Explain Meissner effect, Isotope effect–specific heat behavior for Super Conductors
   d) Mention Various Applications of superconductors

Section B

Answer any FIVE Questions 5 x 3= 15

5. Describe the crystal structure of diamond and show the reciprocal lattice for B.C.C. is F.C.C. lattice.

6. What are the additional features of vibrational spectrum of a diatomic lattice Compared to a monoatomic lattice.

7. State and explain Hall Effect. How positive Hall Coefficients can be explained?

8. Obtain the effective number of free electrons in a partially filled band and hence Classify solids.

9. What are electron orbits, hole orbits and open orbits?

10. What are external orbits? In gold the magnetic moment has a period of 2×10^{-9} gauss^{-1}. Calculate the area of external orbit.

11. What are external orbits? In gold explain the concept of crystal momentum of an electron based on the restatement of Bloch's theorem

12. Explain Brillouin zones.

	P.R. Government College (A), Kakinada	Program & Semester II M.Sc. (III Sem)			
Course Code PHY 303	Lasers and Nonlinear Optics				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the process involved in the production of LASER and their types.
CO2	The concept of resonator and LASER switching modes.
CO3	Understand the principle of optical fiber, types and modes of optical fiber.
CO4	Grasp the concepts of fabrication of optical fiber and the parameters related to light propagation through it.

MODULE-I

LASER SYSTEMS :Light Amplification and relation between Einstein A and B Coefficients. Rate equations for three level and four level systems. Laser systems: Ruby laser, Nd-YAG laser, CO_2 Laser, Dye laser, Excimer laser, Semiconductor laser.

MODULE – II:

LASER CAVITY MODES: Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

MODULE-III

OPTICAL FIBER WAVEGUIDES : Basic optical laws and Self focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

FIBER CHARACTERISTICS : Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. fiber splicing techniques, fiber connectors.

MODULE-IV

HOLOGRAPHY AND FOURIER OPTICS

Introduction to Holography: Basic theory of Holography , Recording and reconstruction of Hologram, Fourier transform Holography, Acoustic and Holographic Microscopy, Pattern recognition and Applications of Holography.

Fringe contrast variation.Fourier Transformation spectroscopy. Michelson interferometer. Advantages of Fourier transforms.Optical data processing.Diffraction. (Meyer. Fowles)

TEXT BOOKS:

1. Lasers -Theory and Applications – K.Thyagarajan and A.K. Ghatak. (MacMillan)
2. Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)
3. Lasers and Non Linear Optics. B.B.Laud, New Age International Publishers
4.Introduction to Modern Optics. Grant R. Fowles,Holt,Rinehart and Winston,Inc New York (1968)

REFERENCE BOOKS:

1. Laser fundamentals – William T. Silfvast (Cambridge)
2. Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)

P.R.Govt.College(A):Kakinada
DEPARTMENT OF PHYSICS
III SEMESTER
M.Sc PHYSICS
(Effective from2020-21 admitted batch)
PHY303: LASERS AND NONLINEAR OPTICS
Model Question Paper

Time 3 Hours **Max Marks 75**
Answer All Questions **4 x 15 =60**

1.a) Write Rate equations in Three level Laser systems.

OR

b) Explain in detail mechanism of population inversion and working of CO_2 laser.

2.a) Explain emission broadening and arrive at an expression for Full width at half Maximum due to radiative decay of atoms.

OR

b)Write about Q-switching along with its types.

3. a)Discuss various types of Optical fibers.

OR

b) Write about modes in step -index fiber.

4 . a) . Write the Basic theory of Holography, Explain about Recording and reconstruction of Hologram

OR

b). Write about Michelson Interferometer.

SECTION-B

ANSWER ANY five QUESTIONS **(5 x3 = 15 marks)**

5. Population Inversion.
6. Deduce relation between Einstein A and B coefficients.
7. Line shape function
8. ABCD matrices
9. Optical laws
10. Core -Cladding losses in optical fiber.
11. Applications of Holography
12. pattern Recognition.

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 304	**Digital Electronics & Microprocessors**	II M.Sc. (III Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the number systems and codes used in modern computer world and their manipulations; Boolean algebra, K-Map, Logic gates and their operations; Combinational logic circuits
CO2	The operation of sequential logic circuits such as flip flops, counters registers and A/D and D/A Converter circuits.
CO3	The concepts of 8085 microprocessor architecture, pin configuration, addressing modes, instruction set and ALP Programming.
CO4	the concepts of interfacing of peripheral devices to 8085 microprocessor.

MODULE - I

Digital Circuits **(i) Number Systems and Codes:** Binary, Octal, Hexadecimal number systems, Gray code, BCD code, ASCII code.(ii) Logic Gates and Boolean Algebra: OR, AND, NOT, NOR, NAND gates, Boolean theorems, DeMorgan law**s.**
II) Combinational Logic Circuits: (i) Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, EX-OR, EX-NOR gates, ENCODER, DECODER, Multiplexer, Demultiplexers.
(ii) Digital Arithmetic Operations and Circuits: Binary addition, Design of Adders and Subtractors, Parallel binary adder, IC parallel adder.(iii) Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

MODULE - II

Sequential Logic Circuits:(i) Flip-Flops and Related Devices: NAND latch, NOR latch, Clocked flip-flops, Clocked S-C flip-flop, J-K flip-flop, D flip-flop, D latch, Asynchronous inputs, Timing problem in flip-flops.(ii) Counters: Asynchronous counters (Ripple), Counters with MOD number < 2^N, Asynchronous down counter, Synchronous counters, Up-down counter, Presettable counter.
(iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO
(iv) Applications of Counters: Frequency Counter and Digital clock.
A/D and D/A Converter Circuits: D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

MODULE – III Intel 8085 Microprocessor:

Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle and write Cycle.

Programming the 8085 Microprocessor:

(i) Addressing Methods, Instruction set, Assembly language programming.
(ii) Examples of Assembly Language Programming: Simple Arithmetic - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Masking of digits, word disassembly.
(iii) Programming using Loops: Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

MODULE – IV Data Transfer Technique:

Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer.

8085 Interfacing:

I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

TEXT & REFERENCE BOOKS:

1. "Digital Systems – Principles and applications" –Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.
3. " Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh & P.R.Sridhar
4. "Microprocessor Architecture, Programming and Applications with the 8085 /8080A" – Ramesh. S. Gaonkar.

P.R.Govt.College(A):Kakinada
DEPARTMENT OF PHYSICS
M.Sc. PHYSICS
III SEMESTER
(Effective from 2020-21 admitted batch)
PHY304: DIGITAL ELECTRONICS & MICROPROCESSORS
Model Question Paper

Time : 3 hrs **Marks : 75**

SECTION - A **4 X 15 = 60.**

Answer all Questions

1. a) Construct a 3 to 8 line Decoder and explain its working.
   b) Discuss the functioning of a BCD to seven segment decoder/ driver.

   Or

   c) With neat logic circuit diagram explain the working of a EX-OR and Equivalence gates. Show that EX-OR is compliment of Equivalence
   d) With neat circuit diagram explain the working of a full adder

2. a) Discuss the working of digital frequency counter
   b) Explain with the help of necessary truth table the working of 3 – bit UP/ DOWN COUNTER.

   Or

   c) Explain the principle of a A/D and D/A converter in signal processing
   d) With a neat circuit diagram explain the successive approximation method of A/D conversion

3. a) Explain the functional description of 8085 microprocessor with a block diagram
   b) Explain the different addressing modes of 8085 microprocessor with suitable examples.

   or

   c) Explain the classification of Instruction set of 8085 microprocessor with suitable examples.
   d) Write an assembly language program to find the sum of series of 8-bit numbers

4. a) With the help of neat block diagram explain the functioning of 8255 PPI, Explain the different modes of operation
   b) Explain the control word of 8255

   Or

   c) Draw the block diagram of 8253 programmable interval timer and explain the functioning of each block
   d) Explain the operation of 8253 as square wave generator

SECTION - B

Answer any Five Questions 5 x 3 = 15

5. Explain the DMA data transfer scheme

6. Draw the timing diagram of memory read operation

7. Write a note on USART 8251

8. With a neat circuit diagram explain the Ladder type D/A converter

9. Write the circuit diagram of JK flip flop, Explain its operation What is Toggling

10. Explain the syntax and the operation of following instructions
(a) LDA (b) LXI (c) LHLD (d) SHLD

11. Explain the functions of
(a) HOLD and HLDA signals
(b) SID and SOD signals

12. Construct a ripple counter of MOD number 10 and explain its working.

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 305	Digital Electronics Lab	II M.Sc. (III Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	4

Digital electronics

1. Verification of Gates: AND, OR, NOT, NAND, NOR, EX –OR, EX – NOR gates

2. Encoder and Decoder

3 Multiplexer and De multiplexer

4. Adders: Half adder, Full Adder, Paraller Adder

5. Flip Flops (7400, 7402, 7408, and 7446)

6 Decade Counter (IC 7490)

7. Seven segment Decoder/ Driver (7490, 7447)

8 .UP/DOWN Counter IC 74193

9. Digital Comparator (7485)

10 Microprocessor 8085

a. Addition/ subtraction of 8 bit numbers

b. Sum of series of 8 – bit numbers

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 306	Solid State Physics Lab	II M.Sc. (III Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	4

1. Hall Effect: Determination of Hall co-efficient and estimation of charge carrier concentration and mobility.
2. ESR Studies – DPPH - Determination of 'g' value of an electron.
3. X-ray diffraction studies : Determination of lattice constant and number of atoms per MODULE cell
4. Lattice Dynamics: Study of Phonon Dispersion characteristics.
5. Study of Magnetic Hysteresis loops of ferromagnetic materials (B-H Curve)
6. Measurement of Magnetoresistance of Semiconductors (Four probe arrangement).
7. Coupled Oscillators: Study of the normal modes of vibrations of coupled pendulum, strength of the coupling constant and exchange energy.
8. Determination of Dielectric constant – Determination of wavelength of the microwaves in the guide of an x-band test bench and determination of dielectric constant.
9. Measurement of magnetic susceptibility of Paramagnetic solution by Quink's Method.
10. Measurement of magnetic susceptibility of Paramagnetic solids by Gouy's Method.
11. Thermo e.m.f: Calculations of thermo electric power, Fermi energy and carrier concentration of a given sample.
12. Ultrasonic Diffraction study in Liquids

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 401	**QUANTUM MECHANICS-II**	II M.Sc. (IV Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the effect of indistinguishability on the nature of identical particles, Pauli's exclusion principle, Heitler London treatment of hydrogen molecule.
CO2	about various approximation methods in quantum mechanics like time dependent, independent perturbation theories, variational method, WKB approximation, adiabatic perturbation techniques.
CO3	About the fundamentals of scattering, quantum mechanical treatment of scattering problem in central potential and square well potentials, Born approximation and its validity.
CO4	about the basics of relativistic quantum mechanics namely Klien-Gordon approach and Dirac's approach, The concept of electrons and holes from Dirac's theory.

MODULE-I : IDENTICAL PARTICLES AND MOLECULES

Identical Particles: Symmetric and anti symmetric wave functions, Indistinguishability of identical particles, Pauli's exclusion principle. Hydrogen molecule ion, Hydrogen molecule: Hitler London treatment. Oscillations and Rotations of H_2.Concept of Ortho and Para Hydrogen. **(Gupta Kumar and Sharma,Pauling and Bright Wilson)**

MODULE-I I: APPROXIMATION METHODS

Time-independent perturbation method. Effect of anharmonicity on the solution of harmonic oscillator problem. Time-dependent perturbation theory, transition probabilities. Variation technique: application to solve the ground state energy of He atom.WKB approximation method: α-particle decay. Sudden and Adiabatic perturbations. **(Gupta Kumar and Sharma)**

MODULE-III :THEORY OF SCATTERING

The scattering experiment. The method of partial waves. Scattering by a central potential. Zero energy scattering. Scattering by square-well potential, effective range. Resonance scattering**.** Born Approximation, Validity of Born Approximation.
(Aruldhas)

MODULE-IV : RELATIVISTIC QUANTUM MECHANICS

Klein-Gordan equation, Probability and current density, Inadequacies of Klein-Gordan equation.Dirac matrices, Dirac relativistic equation for free particles and solution. Concept of negative energy states. Theory of holes**.** **(Gupta Kumar and Sharma)**

TEXT BOOKS

1. Quantum Mechanics, S.L.Gupta, V.Kumar, H.V.Sharama and R.C. Sharma, Jai Prakash Nath & Co. Meerut,(1996)
2. Quantum Mecanics, G. Aruldhas, Prentice Hall of India Pvt. Ltd, New Delhi (2002).
3. Introduction to Quantam Mechanics with applications to chemistry.Linus Pauling and E.Bright Wilson,Jr. McGraw Hill,Book Company,New York 1935 and London.

REFERENCE BOOKS

1. Quantum Mechanics. B.K.Agarval and Hariprakash, Prentice-Hall of India Ltd., New Delhi, (1997).
2. Quantum Mechanics. L.I.Schiff, Mc Graw Hill Book Co.,Tokyo, (1968)
3. Modern Quantum Mechanics. J.J.Sakurai, Addison- Wesley, Tokyo, (1968).
4. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkateswaran, Tata McGraw Hill, New Delhi, (1976).
5. Introduction to Quantum Mechanics, R.H.Dicke and J.P.Witke, Addison-Wisley Pub. Co. Inc.,London, (1960).

DEPARTMENT OF PHYSICS
M.Sc. PHYSICS
IV SEMESTER
(Effective from 2020-21 admitted batch)
PHY401: ADVANCED QUANTUM MECHANICS

Time : 3 hrs **Model Question Paper** **Max. Marks: 75**

SECTION - A **(4 X 15 = 60)**

Answer all Questions

1 a) Explain Pauli's exclusion principle and describe the Oscillations and Rotations of H_2

OR

b) Discuss about (i) Symmetric and anti symmetric wave functions
(ii) Ortho and Para Hydrogen

2. a) Derive Fermi Golden rule and write is importance in calculating transition probabilities.

OR

By using Variation technique find the ground state energy of He atom

3. a) Explain Born Approximation of Scattering and also explain its Validity .

OR

b)Describe How Scattering problem can be analyzed with the method of partial waves

4. a) Explain Probability and current density . Expain the Klein-Gordan equation and its , , Inadequacies

Or

b) Write about Dirac relativistic equation for free particles and obtain solution

SECTION – B

Answer any Five Questions (5 x 3 = 15)

5. Write a note on Indistinguishability of identical particles.

6. Hitler London Treatment.

7. Write notes on Sudden Approximation

8. Effect of anharmonicity on solution of harmonic oscillator.

9. *Explain briefly* Resonance scattering

10. Define Differential scattering cross section.

11. Discuss the negative energy states.

12. Dirac Matrices.

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 402	**PROPERTIES AND CHARACTERIZATION OF MATERIALS**	II M.Sc. (IV Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	About the effect of thermal interaction with the crystal lattice and how it will react, and also the effect of optical interaction with the crystal lattice and its applications.
CO2	About the various magnetic materials and their thermal properties, they also learn about the fundamentals of SCANNING ELECTRON MICROSCOPE AND TUNNELING ELETRON MICROSCOPE and study of crystal structure using SEM and TEM.
CO3	About the nature of spinning particles and it's interaction with magnetic field. Students would also learn about ESR and NMR and it's applications in the present medical field.
CO4	about electrical and magnetic characterization techniques, these techniques can apply on various materials and we can study the internal structure, physical and chemical properties of the materials

MODULE - I

THERMAL PROPERTIES:

Anharmonic crystal interactions-thermal expansion, thermal conductivity, lattice thermal resistivity, umklapp processes, and imperfections.

OPTICAL PROPERTIES :

Lattice Vacancies, Diffusion, Color Centers—F Centers, other centers in alkali halides, Alloys, Order-disorder transformations, Elementary theory of Order.

MODULE - II

Ferromagnetism and Anti-ferromagnetism

Ferromagnetism: Introduction – Weiss molecular field theory – Temperature dependence of spontaneous magnetization – Heisenberg model – Exchange interaction – Ferromagnetic domains – Magnetic bubbles – Bloch wall – Thickness and energy – Ferromagnetic spin waves – Magnons – Dispersion relations.

Anti-ferromagnetism: Introduction – Two sub lattice model of anti-ferromagnetism – Ferri magnetism - Ferrites – Structure – Applications – Multiferroics.

MICROSCOPIC EXAMINATION:

Fundamentals of Transmission electron microscopy and scanning electron microscopy, study of crystal structure using TEM, study of microstructure using SEM.

MODULE - III

RESONANCE METHODS:

Spin and an applied field—the nature of spinning particles, interaction between spin and a magnetic field, population of energy levels, the Larmor precession, relaxation times—spin-spin relation, spin-lattice relaxation,

Electron Spin Resonance: Introduction, g-factor, experimental methods.

Nuclear Magnetic Resonance—equations of motion, line width, motional narrowing, hyperfine splitting,

Nuclear Gamma Ray Resonance: Principles of Mossbauer Spectroscopy, Line Width, Resonance absorption, Mossbauer Spectrometer, Isomer Shift, Quadrupole Splitting, magnetic field effects, Applications.

MODULE - IV

ELECTRICAL AND MAGENTIC CHARACTERIZATION TECHNIQUES:

DC & AC Conductivity, Curie temperature, Saturation Magnetization and Susceptibility

OPTICAL SPECTROSCOPY:

Fundamentals of Infra-red Spectroscopy and Applications.

TEXT BOOKS:

Solid State Physics, 5th edition, C.Kittel
Fundamentals of Molecular Spectroscopy CN Banwell
Mossbauer Effect and its Applications VG Bhide
Solid State Physics M.A.Wahab

P.R.Govt.College(A):Kakinada
(Effective from 2019-2020 admitted batch)
DEPARTMENT OF PHYSICS
M.Sc. PHYSICS
IV SEMESTER
PHY 402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS

Time : 3 Hrs **Model Question Paper** **Max.Marks :75**

SECTION - A **(4 X 15 = 60)**

Answer all QuestionS

1. a) Give the salient features of lattice thermal conduction in solids. Mention the importance of lattice thermal conductivity studies with temperature.

   Or

   b) What are anharmonic crystal interactions. Explain how lattice thermal conductivity variation can be explained by umklapp and normal processes

2. a) State and explain Fick's laws of diffusion. Obtain the solution for the Fick's second law of diffusion. Explain its applications.

   Or

   b) What are color centers? Describe the structure, models and production of color centres in crystals.

3. a) Describe in detail the Transmission Electron Microscopy Technique and explain the study of crystal structures using it.

   Or

   b) Explain the principle of ESR and its experimental set up.

4. a) Describe the principle of Mossbauer Spectroscopy and explain the hyperfine interaction using Mossbauer effect.

   Or

   b) Describe the fundamentals of IR Spectroscopy

SECTION - B

Answer any Five Questions (5 x 3 = 15)

5. Explain the order-disorder transformations in solids

6. What is SEM? Explain the operation of it.

7. Explain spin – lattice and spin – spin relaxation phenomena

8. Explain the variations of susceptibility and saturation magnetization with temperature

9. What is the significance of g-factor in ESR Spectroscopy? Explain.

10. Write a note on Larmor precession.

11. Discuss AC and DC conductivity of materials

12. Give a brief account on lattice vacancies.

	P.R. Government College (A), Kakinada	Program & Semester: II M.Sc. (IVSem)			
Course Code PHY 403	**COMMUNICATION ELECTRONICS**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	Learnt about different communication techniques like AM, FM&PM and also about Modulation & demodulation techniques
CO2	Learnt about different digital line codes, PAM, PWM, PCM and also about different shift keying techniques like ASK, PSK, & FSK
CO3	Understand the concept of different tuned amplifiers, mixer circuits, filters& oscillators.
CO4	Understand & analyse different types of noises present in communication systems.

MODULE 1: **CW Modulation**:

Amplitude Modulation (AM): **8 periods**

Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power for sinusoidal AM, Amplitude modulator and demodulator circuits, Double side band suppressed carrier (DSBSC) Modulation, Super heterodyne receiver.

Single Side Band Modulation (SSB): **4 periods**

SSB principles, Balanced Modulator, SSB generation

Angle Modulation**:** **8 periods**

Frequency modulation (FM), sinusoidal FM, Frequency spectrum for sinusoidal FM frequency deviation, modulation index, Average power in sinusoidal FM, FM generation

Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

MODULE 2 : **Pulse Modulation :**

Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI , HDBn and Manchester codes, M-ary encoding, Differential encoding **8 periods**

Sampling theorem, Principles of pulse Amplitude Modulation (PAM) and Pulse Time Modulation(PTM) ,Pulse code modulation (PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation(DM) .

Digital Carrier Systems: **8 periods**

ASK, PSK, FSK and DPSK

MODULE 3: **Special Communication Circuits: 6 periods**

Tuned amplifiers :Single tuned amplifier-Hybrid π – equivalent for the BJT, Short circuit current gain for the BJT in CE and CB amplifiers, CE and CB tuned amplifiers, Cascode amplifier.

Mixer Circuits : Diode mixer, IC balanced mixer.

Filters : Active filters, Ceramic, Mechanical and crystal filters.

Oscillators: Crystal oscillator, Voltage controlled oscillator, phase locked loop(PLL).

MODULE 4: **Noise in Communication Systems:** 8 periods

Thermal Noise, Shot Noise, Partition noise, Signal - to – Noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Intersymbol interference (ISI) , eye diagrams.

Text Books:

1. Electronic Communications D. Roody and John Coolin
2. Electronic Communications Systems G. Kennedy
3. Modern Analog & Digital Communications B.P. Lathi.

P.R.Govt.College(A):Kakinada
DEPARTMENT OF PHYSICS
M.Sc. PHYSICS
IV SEMESTER
(Effective from 2020-21 admitted batch**)**
PHY403 : COMMUNICATION ELECTRONICS

Time : 3 Hrs **Model Question Paper** **Max. Marks :75**

SECTION - A **4 X 15 = 60.**

Answer all Questions

1 a) Explain the generation and demodulation of PAM signals
b) Explain what is meant by Pulse Time Modulation

Or

c) Sketch the PCM transmitter and explain about each block
d) Derive an expression for quantization noise in terms of step size

2. a) Explain the principle of working of a super hetero dyne receiver with the help of a block diagram
b) Explain about image rejection and double spotting in super heterodyne receivers

Or

c) Explain in detail the frequency spectrum for sinusoidal FM. Arrive at an equation of average power in sinusoidal FM
d) Explain what is meant by FM Radio detection.

3. a) Derive an expression for the input impedance of tuned amplifiers
b) Draw the circuit diagram of a IC balanced mixer and explain its working

Or

c) Distinguish between ceramic and mechanical filters
d) Draw the ∏ equivalent circuit of BJT and explain the various parameters

4. a) Explain how thermal noise power varies with (i) temperature (ii) frequency and bandwidth
b) Explain why inductances and capacitances do not generate noise.

Or

c) Give a detail account of antenna parameters
d) Explain what is meant by YAGI –UDA antenna

SECTION - B

Answer any Five Questions 5 x 3 = 15

5. Explain the need of Mixer circuits. Draw the circuit diagram of diode mixer

6. Draw the equivalent circuit of piezoelectric crystal and explain how it can be used as a filter

7. Explain the uses of phase locked loop

8. Give a brief sketch of ASK

9. Describe the DPSK transmitter

10. Explain the principle of operation of frequency synthesizer

11. Give a brief account on delta modulation

12. Explain what is meant by DSBSC.

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 404	ANTENNA THEORY AND RADIOWAVE PROPAGATION	II M.Sc. (IV Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		4	1	-	4

Course Outcomes:

On Completion of the course, the students will be able to learn	
CO1	Students will be able to define various antenna parameters, Analyse radiation patterns of antennas
CO2	Evaluation of antennas for given specifications
CO3	Applications of Antennas
CO4	Use of mobile phones, WIFI, internet ,TV broadcasting FM- broadcasting

MODULE - I

Radiation

Potential functions of electromagnetic fields. Potential function for sinusoidal oscillations. Fields radiated by an alternating current element. Power radiated by a current element and radiation resistance. Radiation from a quarter wave monopole or a half wave dipole. EM field close to an antenna and far field approximation.

(Chapter 10 in Jordan and Balmain) ***6 Hrs.***

Antenna Fundamentals

Definition of an antenna. Antenna properties – radiation pattern, gain, directive gain and directivity. Effective area. Antenna beam width and band width. Directional properties of dipole antennas.

(Chapter 11 in Jordan and Balmain and Chapter 2 in Kraus) ***8Hrs.***

MODULE - II

Antenna Arrays

Two element array. Linear arrays. Multiplication of patterns and binomial array. Effect of Earth on vertical patterns. Mathematical theory of linear arrays. Antenna synthesis – Tchebycheff polynomial method. Wave polarization.

(Chapter 11 and 12 in Jordan and Balmain and Chapter 4 in Kraus) ***10 Hrs.***

Impedance

Antenna terminal impedance. Mutual impedance between two antennas. Computation of mutual impedance. Radiation resistance by induced emf method. Reactance of an antenna. Biconcal antenna and its impedance.

(Chapter 14 in Jordan and Balmain and Chapters 8.1 –8.5 in Kraus) ***6 Hrs.***

MODULE - III

Frequency Independent (FI) Antennas

Frequency Independence concept. Equiangular spiral. Log Periodic (LP) antennas. Array theory of LP and FI structures.

(Chapter 15 in Jordan and Balmain and Chapter 15 in Kraus) ***6Hrs.***

Methods of excitation and Practical Antennas

Methods of excitation and stub matching and baluns. Folded dipole, loop antennas. Parasitic elements and Yagi-Uda arrays and Helical antenna.

(Chapter11.15 in Jordan and Balmain) ***6Hrs.***

MODULE - IV

Radio Wave Propagation

Elements of Ground wave and Space wave propagation. Tropospheric propagation and Troposcatter. Fundamentals of Ionosphere. Sky wave propagation – critical frequency, MUF and skip distance.

(Chapter 16 and 17 in Jordan and Balmain) ***8Hrs.***

BOOKS

1.”Electromagnetic waves and Radiating Systems” by E.C.Jordan and K.G.Balmain

2.”Antennas” by J.D.Kraus. (Second Edition)

P.R.Govt.College(A):Kakinada
DEPARTMENT OF PHYSICS
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IV SEMESTER

(Effective from 2019-2020 admitted batch)

PHY404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION

Time : 3 Hrs **Model Question Paper** **Max. Marks :75**

Answer all Questions (4 X 15 = 60)

1 a) Derive an expression for power radiated by a current element and find the radiation resistance.

Or

b) Briefly explain Antenna beam width and Antenna band width.

c) Explain the directional properties of dipole antennas?

2. a) What is Linear array? Explain.

b) Explain Mathematical theory of Linear array.

Or

c) What is Terminal Impedance? Explain.

d) Write a short note on Computation impedance and mutual impedance.

3. a) Explain frequency impedance concept.

b) What do you understand by an FI structures?

Or

c) What are Looping Antennas? Explain.

d) Briefly explain about Helical Antenna.

4. a) Describe the element of Space wave propagation with neat diagram.

b) Give a short note on Critical frequency.

Or

c) Describe the structure of ionosphere.

d) What is Sky wave propagation? Explain.

SECTION - B

Answer any Five Questions (5 x 3 = 15)

5. Explain the terms (a) power gain (b) directivity.
6. What is Radiation resistance?
7. Write a short note on binomial array.
8. Write a short note on Linear arrays.
9. Write a short note on log periodic antennas.
10. Write about yagi-uda arrays.
11. What is Tropospheric propagation?
12. What is Maximum usable frequency (MUF)?

	P.R. Government College (A), Kakinada	Program & Semester			
Course Code PHY 405	Microprocessor Lab	II M.Sc. (IV Sem)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	4

1.Decimal addition of 8 – bit numbers

2 Addition of two 16 – bit numbers

3 Multibyte addition

4.Sum of series of 16 – bit numbers

5.Word Disaasembly

6. Largest number in an array

7. Ascending order of array of 8 - bit number

8. Interfacing of 8255 PPI: generation of square wave and rectangular waves

9. Interfacing of 8253 programmble timer: Mode 1, Mode2, Mode3, Mode 4, Mode5

10 0800 DAC interfacing : generation of square, triangular and stair case wave forms

	P.R. Government College (A), Kakinada	Program & Semester II M.Sc. (IV Sem)			
Course Code PHY 406	**Communication Electronics Lab**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:				6	4

LIST OF EXPERIMENTS

1. AMPLITUDE MODULATION
2. FREQUENCY MODULATION AND DETECTION
3. MIXER
4. BUTTERWORTH FIRST ORDER LOWPASS AND HIGHPASS FILTERS
5. CHEBYSHEV SECOND ORDER LOWPASS FILTER
6. PHASE LOCKED LOOP (PLL)
7. PULSE MODULATION-PAM-AND SAMPLING
8. STUDY OF PRE- EMPHASIS AND DE- EMPHASIS CIRCUITS
9. GENERATION OF PWAM, AND PPM USINGPLL AND 555 TIMER
10. STUDY OF FSK TRANSMISSION AND RECEPTION
11. OPTICAL FIBRE –BENDING LOSSES AND NUMERICAL APERTURE
12. MEASUREMENT OF BIT ERROR RATE (BER)
13. MEASUREMENT OF SPEED OF LIGHT IN OPTICAL FIBRE
14. DETERMINATION OF FREQUENCY AND WAVELENGTH IN A RECTANGULAR WAVEGUIDE IN $TE_{1,0}$
15. DETERMINMATION OF STANDING WAVE RATIO AT REFLECTION COEFFICIENT
16. STUDY OF ISOLATOR /CIRCULATOR
17. MEASUREMENT OF GAIN ,FRONT TO BACK RATIO,BEAM WIDTH OF RADIATION PATTERN IN HALF WAVE DIPOLE
18. FIVE ELEMENT YAGI UDA ANTENNA
19. HELICAL ANTENNA
20. CUT –PARABOIDAL REFLECTOR ANTENNA

Annexures

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

Allotment of Extra credits guidelines

Sl.No.	Activity	Details of achievement	Credits
1	**MOOC Course**	*SWAYAM /NPTEL /CEC etc., (Course Completion certificate with credits should be produced for the claim of extra credits)*	*Total credits achieved will be considered*
2	**NCC**	*B CERTIFICATE*	*2*
		Participation in National Camp after 'B' certificate	*3*
		C certificate	*4*
		Adventure camp/RD parade along with 'B'	*5*
		Failed in B certificate Examination	*1*
3	**Sports**	*Intercollegiate selection*	*2*
		South zone selection	*3*
		All India participation	*4*
		Winning medals in all India competitions	*5*
4	**NSS**	*40% attendance in regular NSS activities*	*1*
		50% attendance with CommMODULEy Service	*2*
		Conduct of survey/Youth exchange/RD	*3*
5	**JKC**	*Enrollment and training*	*1*
		Campus recruitment local level	*2*
		MNCs/reputed companies	*3*
6	**CommMODULEy service**	*Participation in commMODULEy service by departments (outreach programmes)*	*2*
7	**Cultural activity**	*Winning medals at state level-2,* *District level-1*	*2* *1*
8	**COP/Add on Course**	*Pass in Certificate Exam-1,* *Diploma-2*	*1* *2*
9	**Support services**	*Lead India, Health club, RRC and Eco Club etc., participation in various programmes*	*1*

ACADEMIC CO ORDINATOR

PRINCIPAL

P. R. GOVERNMENT COLLEGE (A), KAKINADA

Department of Physics & Electronics

Action Plan - 2022-23

The department of Physics and Electronics is planning to conduct the following programs for the academic year 2022-23

S.No.	Activity	Probable date to be conducted	Remarks
1	Post admission test, Student Counselling Discussion on Result Analysis	Oct3th week	
2	Sensitization on Departmental Activities particularly on Kasarabada Scholarship and Endowment Prizes	Oct4th week	
3	**Parent -Teacher meeting**	Nov 1st week	
4	Disbursement of Kasarabada Scholarship both for UG and PG	Nov 2nd week	
5	Celebration of Birth day of Sir C.V.Raman	7.11.2022	
6	Guest Lecture -1	Nov3rdweek	
7	Launching Upkar Scheme	Nov4thweek	
8	Extension activity - **Open Lab for School students**	Dec 2nd week	
9	Awareness programme on IMD	Dec3rd week	
10	Guest Lecture -2	Jan 3rd week	
11	Study Area Programme / CSP	Jan4th week	
12	Workshop / Intercollegiate Science Competitions	February 2nd week	
13	**National Science day celebrations**	**28.02.2023**	
14	Student Counselling before commencement of semester end exams	Feb 4th week	
15	Guest Lecture - 3	Mar 2nd week	
16	Parent Teacher Meeting	April 1st week	
17	Online Quiz programme	May 1st week	
18	Field visit	Jun 2nd week	
19	Guest Lecture - 4	July 1st week	
20	Observing World Chess Day	20.07.2023	
21	Parent Teacher Meeting	Aug 1stweek	
22	Observing Hiroshima/ Nagasaki Day	6.8.2023/ 9.08.2023	
23	UPKAR scheme – Disbursement of scholarships to the students	August 3rd week	
24	Observing World Ozone Day	16.09.2023	