

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE**

**( AUTONOMOUS )**

**KAKINADA**

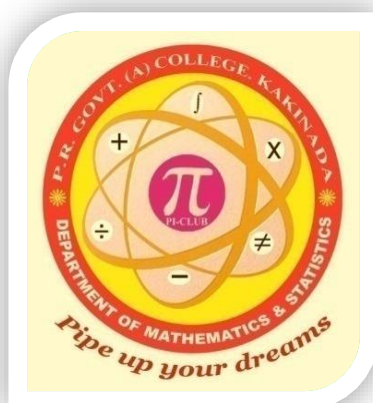
**( Accredited by NAAC "A" Grade with 3.17 CGPA )**

**UG BOARD OF STUDIES : 2024 - 25**



**DEPARTMENT OF MATHEMATICS**

**Curriculum for the Academic Year 2024 - 25**



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**DEPARTMENT OF COLLEGIATE EDUCATION GOVERNMENT OF ANDHRAPRADESH**

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

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

Rc.No.2/A.C/BOS/2024-25

Dt.23 Apr 2024

Sub: P.R.G.C[A] – Academic Cell - **Conduct of BOS Meetings for the Academic Year 2024-25**– Guidelines issued - Regarding.

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 by 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 embark upon rolling out 21<sup>st</sup> century students capable of facing challenges, adaptive to changes, creative and innovative, well rounded students equipped with inventive and creative skills, out-of-box thinking skills, problem solving skills, employability skills, etc., that translate them into leaders and potential entrepreneurs. Hence, the policy recommended internships/ apprenticeships embedded programs. Further, the policy laid much emphasis on rolling out environmentally conscious, value driven, constitution-respecting and socially responsible citizens too.

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, integrating IT into teaching-learning and help students experience and prescribed a wide range of participative and experiential learning experiences 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, collaborations, consultancies, community outreach strategies and encouraged HEIs to be distinctive and unique in practices.

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.

Further, the A.P State Council of Higher Education, in the Post Graduation eco-system has come out with a revised curricular frame work from the Academic Year 2024-25

incorporating Skill Enhancement Courses, Open Online Courses, Indian Knowledge System, projects works in VI semester, besides new credit structure ( APSCHE's curricular frame enclosed).

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 institution's vision and mission, SDG-4, NEP – 2020, NAAC, NIRF to the autonomous HEIs, to meet the expectations of industries, students, Government and in tune with the APSCHE's revised and new P.G Curricular framework we need to customize, design and re-orient our academic and research administration.

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 in the Third week of April 2024. 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.

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 75% for I & II mid-term examinations 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 2024-25, if any, number of certificate courses, their frequency, Bloom 's- Taxonomy based evaluation system for effective learning outcomes as per the Annexure – I.

Pre-BoS activity:

1. The Chairmen shall send the curricula designed for AY 2023-24 to the Industrialists, Alumni, parents and senior subject experts and get feed back and input on the quality of the syllabi, extra-curricular activities, student-centric activities by 6 April 2024.
2. The Chairmen are, therefore, requested to
  - Design curricula of Odd and even semesters for the A.Y 2024-25 both for U.G (I to VIII semesters)and P.G(I to IV Semesters) courses in tune with the stated vision, mission of the institution, RAF of NAAC, NEP-2020 and NIRF.
  - It is mandatory to change the syllabus every year for a maximum of 20% .
  - Conduct meeting with employers, parents, alumni, shall take feedback on the existing curriculaand invite 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.
  - **The Subject experts should be preferably a Doctorate with more than 10 years of teaching experience. He should have experience in designing industry related, market and job oriented curriculum.**
  - Facilitate much room for intense deliberation on the design of the curricula, evaluation

system, research component, enhancing learning experiences, resource utilization by staff and 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 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 IQAC coordinator will be the additional coordinator.
- The Academic Coordinator and IQAC coordinators will conduct a meeting with the Chairmen, BOS on 25 April 2024 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 to each Chairman towards each course (If BOS meetings for multiple courses are held under one Chairmanship, he/she shall be given advance amount equivalent to the number of courses 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).

The chairmen of BOS are instructed to take suggestions from Industrialist (Part of Pre BOS) who is not in the previous BOS as member from industrialist category regarding the change in syllabus for the papers in BOS 2023-24 and proposal for new courses for the Academic year 2024-25 keeping in view of the future job opportunities .

S.No	Title of the Paper	Feedback or suggestions on the curriculum designed during 2023-24 BoS(Whether industry oriented/ relevant for equipping skills for 21st century students)	Proposal of New Courses for 2024-25	Justification

**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 science subjects

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 Bench marking 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 following table incorporated

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

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.
9. Attendance of Members present with signatures in the tabular form.
10. List of Examiners & Paper setters (Minimum 20 members list)
11. 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.
12. Each student (2024-25 AB) has to complete one MOOCS course from SWAYAM in any subject per year which is mandatory.

#### CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
  - I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
- Question paper is to be given as per the following structure for the courses with **4 units**

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5 M)	Objective Questions(1M)
1	I	1	0	1
2	II	1	0	1
3	III	0	2	1
4	IV	0	2	1+ one question from anyunit with more syllabus weightage

- For I mid examination to be conducted in offline mode, Question paper is to be given as per the following structure for the courses with **5 units**

□

S.No	Unit No	Long Answer Question(10M )	Short Answer Question(5 M)	Objective Questions(1M )
1	I	1	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from anyunit(III or IV or V) with more syllabus Weightage	1

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M
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#### CIA structure for 3 Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions with one mark each.
- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M
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#### CIA structure for 3 Major system for Honors programmes(2020-21AB)

- Out of 40 marks for CIA, 20 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **Two essay** questions for ten marks each out of three questions, **four short** answer questions with five marks each out of six questions.
- The remaining 20 marks for CIA are allocated as per the following structure.

Assignment- 10M	Seminar- 5M	Quiz -5M
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13. Percentage of syllabus changes in each paper

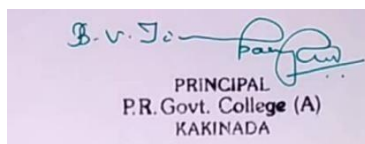
14. Measure outcome attainment learning levels of students through direct and indirect methodology and mapping COs and POs

15. Text & Reference Books

16. e-content links.

The BoS meetings should be conducted as per the scheduled timelines given below.

S.No	Activity	Scheduled Date
1	Issuing notification for conduct of BoS meetings	23.04.2024
2	Pre BOS (Offline/Online)	25.04.2024
3	Departmental level curricula design	27.04.2024
4	Finalization of draft BOS	27-04-2024
5	Scrutiny by academic cell	29-04-2024
6	Correspondence with Subject experts, University nominees, Industrialists	28-04-2024
7	BOS for UG & PG	30-04-2024



B. V. J.

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KAKINADA

**PRINCIPAL**

**Pithapur Rajah's Government Autonomous  
College Kakinada**

Enclosures: Annexures- I, II & III Copy to:

Lecturers-in-Charge (BOS Chairmen) of all the departments

Academic Coordinator IQAC coordinator Controller of Examinations

Office



OFFICE OF THE DEAN, ACADEMIC AFFAIRS  
**ADIKAVI NANNAYA UNIVERSITY**  
RAJAMAHENDRAVARAM

No. ANUR/DAA/PR Govt. College (A)/Sub. Experts/2021

Date: 22-10-2021

**PROCEEDINGS OF THE VICE-CHANCELLOR**

**Sub:-** ANUR- DAA – Nominated University Subject Experts for BOS – PR Govt. College (A), Kakinada – Orders - Issued.

**Ref:-** 1. Lr. dated 15.09.2021, from the Principal, PR Govt. College (A), Kakinada  
2. Proc. No: ANUR/PRG College (A), KKD/UG BoS/2019/09, dated 19.03.2019

**Read:-** Note for Orders of the Vice-Chancellor dated 21.10.2021

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**ORDERS**

Having consider the request cited in the ref. 1, the Vice-Chancellor is pleased to order that the following members be nominated as University Subject Experts for UG Board of Studies of **PR Govt. College (A), Kakinada** for a period of three years from the date of the proceedings issued.

S.No.	UG Courses	Name of the Subject Expert
1	English	Dr. Prasanthi Sree, AKNU MNS Campus, Kkd, Ph No: 9848297555, <a href="mailto:sathupathi.sri@gmail.com">sathupathi.sri@gmail.com</a>
2	Hindi	Dr. N Venkata Ramana, SKBR College, Amalapuram, Ph. No: 9849373773
3	Telugu	Dr. P. Nagaraju, GDC, Palakollu, Ph.No: 9052038569, <a href="mailto:raju00517@gmail.com">raju00517@gmail.com</a>
4	Sanskrit	Dr. TGY Acharyulu, SKR Womens College, Rajahmundry, Ph. No: 9848628812
5	Mathematics	Dr. V. Anantha Lakshmi, Principal, GDC Pithapuram, Ph. No : 9963786386, <a href="mailto:ananthamaths@rediffmail.com">ananthamaths@rediffmail.com</a>
6	Statistics & Actuarial Sciences	Dr. D V Ramana Murthy, HoD of Statistics, SKVT College, Rajamahendravaram, Ph.No: 9949135864, <a href="mailto:drdvrmurthy@gmail.com">drdvrmurthy@gmail.com</a>
7	Chemistry & Analytical Chemistry	Dr. K. Jhansi Lakshmi, Principal, Ideal College of Arts & Sciences, KKD, Ph.No: 9441236409, <a href="mailto:jhansikalisindi@gmail.com">jhansikalisindi@gmail.com</a>
8	Physics & Electronics	Dr. Paul Diwakar, Sri CRR College (A), Eluru, 9985050696
9	Petro Chemicals	Dr. M Trinadh, Lecturer in Chemistry, Govt. College (A), Rajahmundry, Ph. No: 8639551783
10	Bio-Chemistry	Dr. M Suvarchala, Lecturer in home science, ASD women's Degree College, KKD,
11	Food Science	Ph. No: 9346512694, <a href="mailto:suvarchakamallela@gmail.com">suvarchakamallela@gmail.com</a>
12	Botany	Dr. J. Sujatha, Leturer in Botany, GDC Rjy, Ph.No: 9441050910, <a href="mailto:drjsuncetha@grjy.ac.in">drjsuncetha@grjy.ac.in</a>
13	Microbiology	Dr. D Aruna, Lecturer in Micro-biology, ASD Women's College, Kakinada, Ph. No: 9182525872
14	Zoology	Dr. B. Tejo Murthy, Lecturer in Zoology, GDC Yeleswaram, Ph. No: 9703799970, <a href="mailto:drmtm2011@gmail.com">drmtm2011@gmail.com</a>
15	Bio Technology	Dr. B. Nageswari, Lecturer in Biotechnology, GDC Rjy, Ph. No: 986621955

16	Commercial Aquaculture	Dr. P Ramamohana Rao, Aquaculture Consultant, KKD, Ph. No: 9885144557, <a href="mailto:asreenivasulu@gmail.com">asreenivasulu@gmail.com</a>
17	Computer Science & Computer Applications	Mr. N. Naga Subrahmanyesweri, Lecturer in Computer Science, ASD Women's College, KKD, Ph. No: 9948438376, <a href="mailto:yesweri.velugu@asddgcw.ac.in">yesweri.velugu@asddgcw.ac.in</a>
18	Commerce	Dr. K. Ratna Manikyam, Govt. College (A), RJY, Ph. No: 8919230362, <a href="mailto:drkrm@grjy.ac.in">drkrm@grjy.ac.in</a>
19	Economics	Dr. D. V. Nageshwara Rao, Lecturer, GDC, RJY, Ph. No: 9490919676
20	History	Dr. B. Anjani Kumari, Lecturer in charge, GDC (W), Ph. No: 891989337
21	Philosophy	Dr. V. Venkatarao, Lecturer in Philosophy, MR College, Vijayanagaram, Ph. No: 9440096609
22	Political Science	Dr. Seetha Mahalaxmi, Lecturer in Political Science, GDC, RJY Ph. No: 9491011844
23	Journalism & Mass Communication	Prof. DVR Murthy, Dept. of Journalism & Mass Communication, Andhra University, Vishakapatnam, Ph. No: 9985051793, 9440974092
24	Horticulture	Dr. J. Sujatha, Lecturer in Botany, GDC, Rjy, Ph. No: 9441050910, <a href="mailto:drjsuneetha@grjy.ac.in">drjsuneetha@grjy.ac.in</a>
25	Pharmaceutical Chemistry	Dr. K. Deepthi, Asst. Professor, Dept. of Chemistry, AKNU, Rjy, Ph. No: 9985469607, <a href="mailto:deepthikorabandi@gmail.com">deepthikorabandi@gmail.com</a>

(BY ORDERS)

  
Dean 22/10/21  
ACADEMIC AFFAIRS

To  
The Principal, PR Govt. College (A), Kkd  
PA to R  
PS to VC,  
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**Proceedings of the Principal, PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A):  
Kakinada**

**Present : Dr.B.V.Tirupanyam,Ph.D**

**Rc.No.1/A.C./BOS/2024-25, Dated: 23 APR 2024**

**Sub: P.R.Government College (A), Kakinada-Board of Studies(BOS)-Program / Course  
Nomination of members-Orders issued.**

**Ref: UGC Guidelines for Autonomous Colleges – 2018**

**ORDER:**

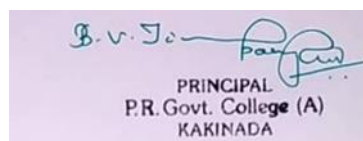
The Principal, P.R.Govt.College(A), Kakinada is pleased to constitute Board of Studies in MATHEMATICS for framing the syllabi in Mathematics subject for all semesters duly following the norms of the UGC Autonomous guidelines.

<b>S.No</b>	<b>Name with Designation and Address</b>	<b>Designation</b>
1	Dr. K.Jaidev I/C of Mathematics P. R. Govt. College (A), Kakinada	Chair Person
2	Dr. V.Anantha Lakshmi Principal, A.S.D.Govt degree college for women (A) , Kakinada	University Nominee
3	i) Dr. P. Subhashini, Principal Government Degree College, Pithapuram . ii) Sri. K. Chittibabu, Lecturer in Mathematics, Government Degree College, Mummidivaram.	Subject expert
4	Sri. P. S. R. Subrahmanyam, Rtd. HOD of Mathematics, Ideal College of Arts & Science (A), Kakinada	Alumni Member
5	Sri. G .Syam Prasad	Faculty of the Department
6	Sri. G. Prasada Rao	Faculty of the Department
7	Smt. K.S.I.Priyadarshini	Faculty of the Department
8	Smt. L.S.B.R.Bhanu	Faculty of the Department
9	Smt. K. Samrajyam	Faculty of the Department
10	Smt. N.S.S.Nagadevi	Faculty of the Department
11	Kmt.V.V.Lakshmi Devi	Faculty of the Department
12	Kmt.P.Chitti Sai Lakshmi	Faculty of the Department

13	Smt.S.Sravani Varalakshmi	Faculty of the Department
14	R.V.V.KRISHNA PRASAD	Student Alumni Member B.Sc(M.P.C-TM)-2020-23
15	PENUMARTHI HYMA SUJI BHARATHI	Student Member II B.Sc –Maths Major
16	T.AKHILA	Student Member II B.Sc –Stat Major
17	RUSHINARADAMANGALA NATARAJAN SHIVANI	Student Member III B.Sc –M.P.Cs

The above members are requested attend the BOS meetings and share their valuable views, suggestions on the following functionalities:

- a) Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stakeholders and National requirement for consideration and approval of the IQAC and Academic Council.
- b) Suggest methodologies for innovative teaching and evaluation techniques.
- c) Suggest panel of names to the Academic council for appointment of examiners.
- d) Coordinate research, teaching, extension and other activities in the department of the college.



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Copy to:

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Proceedings of the Principal, PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A):  
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Present : Dr.B.V.Tirupanyam,Ph.D

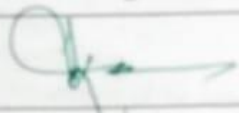

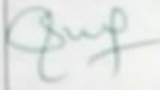
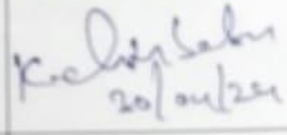
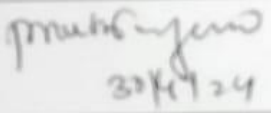
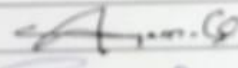
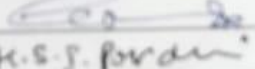
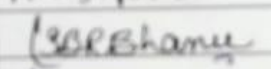
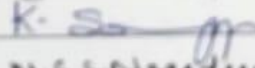
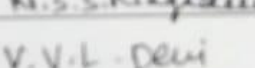
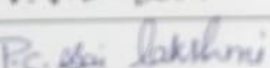
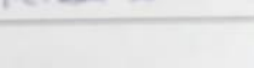
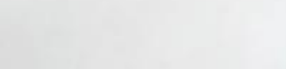
Re.No.1/A.C./BOS/2024-25, Dated: 23 APR 2024

Sub: P.R.Government College (A), Kakinada-Board of Studies(BOS)-Program / Course  
Nomination of members-Orders issued.

Ref: UGC Guidelines for Autonomous Colleges - 2018

**ORDER:**

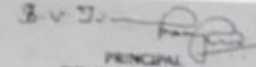
The Principal, P.R.Govt.College(A), Kakinada is pleased to constitute Board of Studies in MATHEMATICS for framing the syllabi in Mathematics subject for all semesters duly following the norms of the UGC Autonomous guidelines.

S.No	Name with Designation and Address	Designation
1	Dr. K.Jaidev I/C of Mathematics P. R. Govt. College (A), Kakinada	
2	Dr. V.Anantha Lakshmi Principal, A.S.D.Govt degree college for women (A), Kakinada	
3	i) Dr. P. Subhashini, Principal Government Degree College, Pithapuram . ii) Sri. K. Chittibabu, Lecturer in Mathematics, Government Degree College, Mummdivaram.	 
4	Sri. P. S. R. Subrahmanyam, Rtd. HOD of Mathematics, Ideal College of Arts & Science (A), Kakinada	
5	Sri. G .Syam Prasad Reddy	
6	Sri. G. Prasada Rao	
7	Smt. K.S.I.Priyadarshini	
8	Smt. L.S.B.R.Bhama	
9	Smt. K. Samrajyam	
10	Smt. N.S.S.Nagadevi	
11	Kmt.V.V.Lakshmi Devi	
12	Kmt.P.Chitti Sai Lakshmi	

13	Smt.S.Sravani Varalakshmi	Sravani
14	R.V.V.KRISHNA PRASAD	N. Varasi
15	PENUMARTHI HYMA SUJI BHARATHI	P. Hyma Suji
16	T.AKHILA	T. Akhila
17	RUSHINARADAMANGALA NATARAJAN SHIVANI	R.N. Shivani

The above members are requested attend the BOS meetings and share their valuable views, suggestions on the following functionalities:

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stakeholders and National requirement for consideration and approval of the IQAC and 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 activities in the department of the college.

  
 PRINCIPAL  
 P.R. Govt. College (A)  
 KAKINADA

PRINCIPAL  
 P.R.GOVERNMENT COLLEGE(A)  
 KAKINADA

Copy to:

- The above individuals
- File

### **Vision & Mission**

#### **i ) Vision :**

- ❖ The Mathematics Department offers a broad and challenging academic program that supports the mission of Pithapur Rajah's Government College (A). We aim to provide high-quality education in graduate Mathematics, meeting the needs of a diverse student body and diverse state population.
- ❖ The department of Mathematics, PRGC(A), has always strived to be among the best Mathematics Department in the Country and has worked towards becoming a centre for advanced research in various areas of Mathematics so that it can contribute to the development of the Nation.
- ❖ Department of Mathematics strives to be internationally recognized for academic excellence through the depth of its teaching and research, and to be locally relevant through its role in the development of the community it serves.

#### **ii ) Mission :**

The mission of the Department of Mathematics is developing distinguished academic programs that keep pace with the latest international scientific developments, taking into consideration the quality standards of qualifying competent professionals who possess logical, scientific and mathematical thinking skills, and scientific research skills in Mathematical sciences, and create a positive work environment that fosters effective teaching, quality scientific research, and constructive interaction with the community.

- To develop analytical skills and logical acumen for problem solving.
- To provide excellent knowledge of mathematical sciences for suitable career and groom them for national recognition.
- To make the students savvy in data analytics.
- To train the students for inter disciplinary application and research.
- To build life skills through value-based education and service-oriented programs.
- To provide platform to acquire abilities to evaluate problems using analytical / numerical techniques.

- To provide a back ground for relating mathematical techniques to solve real life problems.
- To involve faculty in research which enriches teaching – learning process.
- To discover, mentor, and nurture mathematically inclined students, and provide them a supportive environment that fosters intellectual growth.
- To employ effective educational tools for graduate courses, informed by the scholarship of teaching and learning of college – level mathematics.
- to prepare our graduate students to develop the attitude and ability to apply mathematical methods and ideas in a wide variety of careers.
- to prepare future scientists and engineers adequately for the mathematical needs of their disciplines and to give all students on campus a general education in the mathematical science.
  - To perform widely recognized research in focused areas of mathematical and statistical theory, methodology and education.
  - To explore application of mathematics and statistics and engage in collaborative research in an inter disciplinary environment.
  - To provide professional service based on our diverse mathematical and statistical, technical and educational community.

**OBJECTIVES:**

1. To prepare and introduce students to the world of work through development of cognitive skills, discipline-specific skills, technical and professional skills, information processing skills, problem-solving skills, social engagement and emotional skills.
2. To forge collaborations with industry, Government and third sector organizations.
3. To promote intuition among students.
4. To devise plans for rolling out socially conscious, culturally synchronizing and environmentally friendly students.
5. To make students access to ICT infrastructure for enhanced quality higher education.
6. To make students find innovative solutions to societal problems and adapt themselves to.

# PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

## DEPARTMENT OF MATHEMATICS

Meeting of the Board of studies is held at 10AM on 30-04-2024 in the Department of Mathematics, Pithapur Rajah's Government College (A), Kakinada with the following agenda.

### Agenda

1. a) To approve the curriculum, blue print and model paper for I & II year B.Sc Course under CBCS based as per the directions of the APSCHE for the admitted batch 2023 -24 and 2024 – 25 (I,II, III and IV Semesters).  
b) To approve the curriculum, blue print and model paper of practical examinations for I & II year B.Sc Course under CBCS based as per the directions of the AKNU for the admitted batch 2023 -24 and 2024 - 25.( II, III and IV Semester).
2. a) To approve the curriculum, blue print and model paper for III year B.Sc Course under CBCS based as per the directions of the APSCHE for the admitted batch 2022 -23 (V Semesters)  
b) To approve the curriculum, blue print and model paper of practical examinations for 1st year B.Sc Course under CBCS based as per the directions of the AKNU for the admitted batch 2022 -23.( V Semester).
3. To approve the one Certificate Course, Competitive Mathematics for non-mathematics students were introduced in this academic year.
5. To approve the incorporation of additional inputs to various courses (where ever it is felt necessary) for enhancing students understanding over the concerned course and this shall not be considered for evaluation purpose.
6. To approve the Examination procedure for the courses for I, II, III years of B.Sc (2024 – 25, 2023-24 & 2022-23 admitted batches).
7. Each theory subject is evaluated for 100 Marks (I, II & III Years) out of which 50 Marks through semester end examination for I, II & III year and internal assessment would be for 50 Marks for I, II& III year.

#### CIA structure for Single Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions to be given for each paper.
- For I mid examination to be conducted in off line mode , question paper is to be given as per the following structure for the courses with V units.

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5 M)	Objective Questions(1M)
1	I	1	2	2
2	II	1	2	1+ one question from any unit with more syllabus weightage

3	III	0	0	0
4	IV	0	0	0
5	V	0	0	0

- For II mid examination to be conducted in off line mode , question paper is to be given as per the following structure for the courses with V units.

S.No	Unit No	Long Answer Question(10M)	Short Answer Question(5M)	Objective Questions(1M)
1	I	0	0	0
2	II	0	0	0
3	III	1	2	2
4	IV	1	2	2+ one question from any unit(III or IV or V) with more syllabus weightage.
5	V	0	0	0

- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M
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#### CIA structure for 3 Major system

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions with one mark each.
- The remaining 25 marks for CIA are allocated as per the following structure.

Project-10M	Viva on theory- 3M	Assignment- 5M	Seminar- 5M	Clean & green and Attendance- 2M
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#### 8. Scheme of valuation for practical's

- Record - 10 M
- Viva Voce - 10 M
- Test - 30 M
- Total - 50 M

Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.

9. To award two extra credits to students who have registered and completed SWAYAM course successfully.

10. To award 4 credits for each first and second phase of Apprenticeship between 1<sup>st</sup> and 2<sup>nd</sup> year and 2<sup>nd</sup> and 3<sup>rd</sup> year (two summer vacations).

11. To implement pedagogical strategies to enrich teaching and learning process.

12. To approve the proposed departmental activities for 2024 – 25.
13. To approve the list of examiners and paper setters for the academic year 2024 – 25.
14. Any other item with the permission of the chair.

### **Resolutions taken :**

The following resolutions are approved by university nominee and all the members of BOS

- It is resolved to adopt revise syllabus drawn as per APSHE syllabus for the students of B.Sc Program.
- It is resolved to establish a community outreach program for both Students and Lecturers.
- It is resolved by a suggestions BOS member that students need to understand what courses which there and where for them for the studies.
- After reviewing the existing titles and contents of semesters I,II,III,IV and V framed by APSHE, the board come out with the following resolutions.
- It is resolved to introduce a new course for Second year Mathematics Major for the Academic year 2024 – 2025.

S.No	Course Code	Title of the new course	Programmes in which it is introduced
1	Course - VII	Laplace Transforms & Problem Solving Sessions	Mathematics Major
2	Course - VIII	Special Functions & Problem Solving Sessions	Mathematics Major
3	Course - XI	Integral Transforms & Problem Solving Sessions	Mathematics Major

#### Resolution – I

It is resolved to approve the following changes of semester I,II,III,IV and V of Mathematics as it is given by APSCHE.

As a part of this, from this academic year, as per NEP-2020, the major and Minor policy system has come into effect.

According to this, in the Third semester of the Second year, Course – VI, Course – VII, Course - VIII papers and in the Fourth semester – Course – XI were newly introduced.

#### **FIRST YEAR : SEMESTER - II**

1. Practical exams will be included for the students joining the academic year 2024-25.

#### **SECOND YEAR : SEMESTER - III**

2. Course – V: In Group Theory - Cyclic Groups is added in Unit - V.
3. Course – VI: Numerical Methods - Solution of Algebraic and Transcendental equation and Curve Fitting is added in Unit – IV and Unit – V respectively.
4. Course – VII: Laplace Transform is newly introduced.
5. Course – VIII: In Special Functions - Chebyshev polynomials is added in unit – I.
6. Practical exams will be included for the students joining the academic year 2023-24.

➤ **SECOND YEAR : SEMESTER - IV**

1. Course – IX: In Ring theory- Quotient Rings, Homomorphisms of Rings, Rings of Polynomials are added in Unit – III, IV & V respectively.
2. Course – X: In Real Analysis – Alternating Series and Leibnitz Test in Unit – II and Uniform Continuity in Unit – III are added.
3. Course – XI: Integral Transform with Applications is newly introduced.
4. Practical exams will be included for the students joining the academic year 2023-24.

➤ **THIRD YEAR: SEMESTER – V**

1. Practical exams will be included for the students joining the academic year 2022-23.

**Resolution – II**

1. It is resolved to approved the incorporation of additional inputs to various courses (where ever it is felt necessary) for enhancing students understanding over the concerned course and this shall not be considered for evaluation purpose.
2. Resolved to adopt Community Service Project for all the students at the end of Sem –II.
3. Resolved to send all the final year Mathematics students for on job training apprenticeship in connection with industries for off-site Project in the end of Sem V/VI with the industries in accordance with their interest of study.
4. It is resolved to approve the proposed departmental activities for 2024-25.
5. It is resolved to approve the list of examiners and paper setters for the academic year 2024-25.
6. Streamlining of regularity in attendance. Resolved to make the eligibility to appear for 1<sup>st</sup> mid is 75% of attendance for the 2<sup>nd</sup> mid it would be 75% , for 75% of attendance for semester examination and 90% for practical examinations .Also it is resolved that the student should attend at least one internal exam to appear for the Semester end examination.
7. To approve the Analytical Skills paper (Foundation Course) should be taught to all the groups of the First year , following the directions of Adikavi Nannayya University.

8. Resolved to give extra credits for MOOCS courses, N.S.S., N.C.C., winners of zonal level sports and games competitions, participation in state level/ National level competitions, blood donations camps, environmental programs like extending services in facing the natural calamities etc.

9. Resolved to Engaging of 7<sup>th</sup> hour of time table.

10. Resolved to conduct International / National , Webinar / Seminar like Data Science , Artificial Intelligence, etc.,

11. Resolved to introduce new courses of study whenever necessary.

12. Resolved to follow the admission criteria for the programmes offered by the department.

13. Resolved to conduct extension lectures by the eminent persons.

\*\*\*

### **Action Taken Report**

The appropriate action taken by the department of Mathematics as per the suggestions given by the members of Board of Studies and other administrators in the meeting held on 30<sup>th</sup> APR 2024.

**Blue Print of C.B.C.S. Model Curriculum in B.Sc. Mathematics**

Yr.	Course & Theory / Lab	Paper	Title	Workload Hrs / Week	Credits	Max. Marks			Practical
						Intrnl	Extrnl	Total	
<b>I</b>	Sem I	I (Major)	Essentials and Applications of Mathematical, Physical and Chemical	5 Hrs	4	50	50	100	-
		II (Major)	Advances in Mathematical, Physical and Chemical	5 Hrs	4	50	50	100	-
		Skill Course	Analytical Skills	2 Hrs	2	-	50	50	-
	Sem II	III (Major)	Differential Equations & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		IV (Major)	Analytical Solid Geometry & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		I (Minor)	Differential Equations & Problem Solving	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
<b>II</b>	Sem III	VI (Major)	Group Theory & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		VII (Major)	Numerical Methods & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		VII (Major)	Laplace Transforms & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		VIII (Major)	Special Functions & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		II (Minor)	Group Theory & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
	Sem IV	IX (Major)	Ring Theory & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		X (Major)	Introduction to Real Analysis & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50

		XI (Major)	Integral Transforms & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		III (Minor)	Ring Theory & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		IV (Minor)	Introduction to Real Analysis & Problem Solving Sessions	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
III	Sem V	VI A	<b>(To choose One pair from the Three alternate pairs )</b> Numerical Methods	6 Hrs (4T + 2P)	4 + 1	50	50	100	50
		VII A	Mathematical Special Functions	6 Hrs (4T + 2P)	4 + 1	50	50	100	50
			<b>OR</b>						
		VI B	Multiple integrals and Applications of Vector Calculus	6 Hrs (4T + 2P)	4 + 1	50	50	100	50
		VII B	Integral transforms with Applications	6 Hrs (4T + 2P)	4 + 1	50	50	100	50
			<b>OR</b>						
		VI C	Partial Differential Equations and Fourier Series	6 Hrs (4T + 2P)	4 + 1	50	50	100	50
		VII C	Number theory	6 Hrs (4T + 2P)	4 + 1	50	50	100	50

**Note 1:** For Semester–V, for the domain subject **MATHEMATICS**, any one of the three pairs of Skill Enhancement Courses shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABC allotment is random, not on any priority basis).

**Note 2:** One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially

skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

**Note 3:** To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSCHE Guidelines.

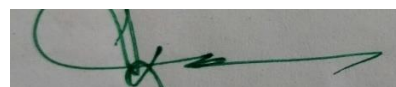
- **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summervacationintheintervening1stand2ndyearsofstudy shall be for Community Service Project (the detailed guidelines are enclosed).
- **CreditForCourse:04 for 100 marks**
- **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shallbeundertakenbythestudentsintheinterveningsummervacationbetweenthe2nd and 3rd years (the detailed guidelines are enclosed).
- **CreditForCourse:04for 100 marks**
- **Third internship/Project work(6<sup>th</sup> Semester Period):**  
During the entire 6<sup>th</sup>Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work (the detailed guidelines are enclosed).
- **CreditFor Course:12for 200 marks**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**BOS CHANGES FROM DEPARTMENT OF MATHEMATICS - ACADEMIC YEAR 2024-25**

S.No.	Semester, Program	Paper Number & Paper Title	Titles of Topics deleted	Topics to be added during BOS meeting October 2023	Percentage of changes made in syllabus	Justification per each topic deleted	Justification per each topic added
1	II Major	Solid Geometry	Number of arbitrary constants in the equations of straight line - Sets of conditions which determine a line.		5%	Not much application oriented	
2	II Major	Solid Geometry	Condition that a cone may have three mutually perpendicular generators; Reciprocal Cone.		5%	Not much application oriented	
3	III Major & Minor	Abstract Algebra		Cyclic groups	10%		Improve investigative skills, resourcefulness and creativity.
4	III Major & Minor	Abstract Algebra		Practical's are Introduced	100%		Improve investigative skills, resourcefulness and creativity.
5	III Major	Numerical Methods		Solutions of Algebraic and Transcendental equations & Curve fitting	40%		Efficient modeling of complex systems, reduced to computational power requirements and the ability to predict future behaviors accurately.
6	III Major	Numerical Methods		Practical's are Introduced	100%		Improve investigative skills, resourcefulness and creativity.
7	III Major	Laplace Transform		Newly Introduced	100%		Wide applications in various fields like Engineering technology, basic sciences and mathematics and in Economics.
8	III Major	Laplace Transform		Practical's are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non-classroom environment.
9	III Major	Special Functions		Chebyshev Polynomials	10%		These topics added for the continuation of higher studies.
10	III Major	Special Functions		Practical's are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non-classroom environment.

10	IV Major & Minor	Ring Theory		Quotient Rings, Homomorphisms of Rings & Polynomial Rings	40%		These topics added for the continuation of higher studies.
11	IV Major & Minor	Ring Theory		Practical's are Introduced	100%		Improve investigative skills, resourcefulness and creativity.
12	IV Major & Minor	Real Analysis		Alternating Series– Leibnitz Test and uniform continuity	10%		These topics added for the continuation of higher studies.
13	IV Major & Minor	Real Analysis		Practical's are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non-classroom environment.
14	IV Major	Integral Transforms with Applications		Newly Introduced	100%		To evaluate a variety of values, including area, work, and more broadly, any number that can be expressed as the area under a curve.
15	IV Major	Integral Transforms with Applications		Practical's are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non-classroom environment.
16	V B.Sc all Groups	Numerical Analysis		Practical's are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non-classroom environment.
17	V B.Sc all Groups	Special Functions		Practical's are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non-classroom environment.
18	V Semester Non-Mathematics Students	Certificate Course-I		Certificate course on Competitive Mathematics for Non- Mathematics Students	Newly Introduced in V semester		Helps an individual to showcase his competency, commitment for the profession, build expertise in his professional subject area, and helps with job advancement.



Signature of the I/C of Department

S.No	Parameter	Unit of Time	Benchmarking (Number/ quantity)	Remarks
1	Certificate courses	Semester-V	1	
2	MOOCs for student	Year -2024-25	Each student (2024-25 AB) has to complete one MOOCs course from SWAYAM in any subject per year which is mandatory.	
3	MOOCs for faculty	Semester	10 (Each faculty one course per year)	
4	LMS by faculty	Semester	10 (Each faculty one topic in each semester)	Each faculty shall prepare topic wise/ chapter wise LMS ( 4-quadrant approach)
5	Field/ industrial/ Educational trips	Year 2024-25	1	Department level – Each dept shall conduct
6	Research papers	Year	2	Minimum one research publication per year per lecturer
7	Conferences/ Workshops/ – National level	Year 2024-25	1	Offline (Preferably one month after commencement of odd/ even semester)



Signature of the I/C of Department

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**ACTION PLAN FOR THE ACADEMIC YEAR 2024-2025**

**Department of Mathematics**

<b>S.No</b>	<b>Activity planned</b>	<b>Dates/ Period</b>	<b>Outcomes/ Objectives</b>
1	Bridge Course	July / II week	Recognize key terms and ideas in academic contexts within in the student's field of interest
2	Independence day Field Trip	August/ III WEEK	To understand the importance of commemoration of Independence day and how they can make changes in the world./ It's providing real-world experience, increases the quality of education and improves the social relations.
3	Teacher's Day	September/ I WEEK	To knowledge the challenges, hardship and special roles that teachers play in our lives.
4	National Conference /Webinar	October/ III WEEK	Learning and knowledge exchange among Conference participants through interdisciplinary discussions.
5	Guest / Extension Lecture	November/ II WEEK	Students are able to understand the role of Mathematics in real world.
6	Town level Quiz ,Elocution computations.	December/ II WEEK	The competitive spirit will be improved among the students.
	Celebration of Mathematics Day on 22 <sup>nd</sup> Dec-2024.	December/ III WEEK	The students will be motivated to pursue higher education in Mathematics.
7	Carrier Guidance	January/ IV WEEK	Employment status, job satisfaction, perceived employability, career success, underemployment, and motivations for seeking new roles.
8	Science Day Celebrations.	February/ IV WEEK	Students will get more interest to do projects and there is a scope to know the applicability of all subjects.
9	Pi Day Celebrations	March/ II WEEK	To impart the knowledge on the significance of PI
10	Mathematics Guest lecture.	April/ I WEEK	Students are able to understand the role of Mathematics in real world.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**Department of Mathematics**

Board of Studies Meeting 2024 -25

**LIST OF EXAMINERS & PAPER SETTERS IN MATHEMATICS**

S.No.	Name of the Lecturer	Address
1	Sri. G. Chandrasekhar	Lecturer in Mathematics, Government College (A), Rajamahendravaram -
2	Dr. Ch. Srinivasulu	Lecturer in Mathematics, Government College (A), Rajamahendravaram - 9948617181
3	Sri. M.Rajeev	Lecturer in Mathematics, Government College (A), Rajamahendravaram - 9441240915
4	Sri. K. Chitti Babu	Lecturer in Mathematics, Government Degree College, Mummidivaram. 9493654033
5	P. Mahalakshmi Naidu	Lecturer in Mathematics, Government Degree College, Perumallapuram - 9491764463
6	Ms. Y. Padmaja	Lecturer in Mathematics, Government Degree College, Ramachandrapuram. 9951773314
7	Sri. T. Srinivas Reddy	Lecturer in Mathematics, Government Degree College, Ramachandrapuram. 7981598769
8	Sri N. Kiran Kumar	Lecturer in Mathematics, Government Degree College, Mandapeta, 9866522999
9	Dr. SK. Sajana	Lecturer in Mathematics, S.R.R. Government Degree College, Vijayawada. 7893918849
10	Smt. M. Madhavi	Lecturer in Mathematics, Government Degree College, Tuni. 9247380632
11	Sri. M. Sri Kameswara Rao	Lecturer in Mathematics, Government Degree College, Pithapuram - 9866219121
12	K. Suresh	Lecturer in Mathematics, Government Degree College, Yeleswaram - 9700203074

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**Certificate of Submission**

The following documents are submitted to the academic coordinator and controller of Examination.

1. Hard copy of the approved curriculum which includes minutes of Board of Studies, Approved Syllabus, blue print for the question papers and model papers for all semesters and list of approved examiners.
2. Soft copy containing the approved curriculum which includes minutes of Board of Studies, Blue print for the question papers and model papers for all semesters and list of approved examiners.



**Chairman**

(Dr.K.Jayadev)

**Academic Coordinator**

**Controller of Examinations**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**DEPARTMENT OF MATHEMATICS**

**Objectives of the Department**

- To impart knowledge on various Mathematical concepts like Differential Equations, Solid Geometry, Group Theory, Real Analysis, Ring Theory and Vector Calculus, Linear Algebra, Numerical Analysis and Special Functions.
- To equip our students with good quality to appear for competitive examinations.
- To make the students to understand the needs of Mathematics in Science and Technology.
- To inculcate research atmosphere among students by assigning projects.

The Department of Mathematics is offering B.Sc. courses involving mathematics (10 courses), B.Sc. Professional (B. Voc.) for undergraduate courses.

**PROGRAMME OUTCOMES**

For every degree program expectations are listed out by the institution under the Program Outcomes. For all Degree Streams the following are set as Programme Outcomes.

<b>PO 1</b>	<b>Domain Expertise</b>	<ul style="list-style-type: none"><li>• Acquire comprehensive domain knowledge and skills.</li><li>• Make use of the knowledge in an innovative manner</li></ul>
<b>PO 2</b>	<b>Life-long Learning and Research:</b>	<ul style="list-style-type: none"><li>• Learn “how to learn”- Self-motivated and self-learning.</li><li>• Adopt to the ever-emerging demands of workplace and life.</li><li>• Investigate the problem and report in a proper manner.</li></ul>
<b>PO 3</b>	<b>Modern Equipment Usage</b>	<ul style="list-style-type: none"><li>• Adopt ICT mode of learning effectively.</li><li>• Access, retrieve and use authenticated information.</li><li>• Have knowledge of software applications to analyze data</li><li>• Usage of technology without deviating from the dedication of learning.</li></ul>
<b>PO 4</b>	<b>Computing Skills and Ethics</b>	<ul style="list-style-type: none"><li>• Develop rational and scientific thinking</li><li>• Ensure the human values &amp; ethics and to follow them throughout the life.</li></ul>

<b>PO 5</b>	<b>Complex problem Investigation &amp; Solving</b>	<ul style="list-style-type: none"> <li>• Predict and analyze problems.</li> <li>• Frame hypotheses.</li> <li>• Investigate and interpret empirical data.</li> <li>• Plan and execute action.</li> </ul>
<b>PO 6</b>	<b>Perform effectively as Individuals and in Teams</b>	<ul style="list-style-type: none"> <li>• Work efficiently as an individual</li> <li>• Cooperate, coordinate and perform effectively in diverse teams/groups.</li> </ul>
<b>PO 7</b>	<b>Efficient Communication &amp; Life Skills</b>	<ul style="list-style-type: none"> <li>• To face challenges and self-sustainability in overcoming the psychological problems.</li> <li>• Listen, understand and express views in a convincing manner.</li> <li>• Develop skills to present information clearly and concisely to interested groups.</li> </ul>
<b>PO 8</b>	<b>Environmental Sustainability</b>	<ul style="list-style-type: none"> <li>• Following the green energy measures.</li> <li>• Understand sensibly the environmental challenges.</li> <li>• Think critically on preventing of environmental pollution.</li> <li>• Propagate and follow environment friendly practices.</li> </ul>
<b>PO 9</b>	<b>Societal contribution</b>	<ul style="list-style-type: none"> <li>• Involve voluntarily in social development activities at Regional, National levels.</li> <li>• Voluntary participation in serving the society from natural calamities viz. disasters, cyclones, epidemics.</li> <li>• Be a patriotic citizen to uphold the constitutional values of the Nation.</li> </ul>
<b>PO 10</b>	<b>Effective Project Management</b>	<ul style="list-style-type: none"> <li>• Adoption of changes time to time in accordance with the situations.</li> <li>• Identify the goals, objectives and components of a project for its completion.</li> <li>• Plan, organize and direct the endeavors of teams to achieve the targets in time.</li> <li>• Be competent in identifying opportunities and develop strategies and decision making for contingencies.</li> </ul>

### Programme Specific Outcomes of Mathematics Stream Courses

PROGRAMME	Program Specific Outcomes
Mathematics Major	PSO 1: Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
	PSO 2: Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.
	PSO 3: Provide advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.
	PSO 4: Prepare and motivate students for research studies in mathematics and related fields.
	PSO 4: Nurture problem solving skills, thinking, creativity through assignments, project work.
MPC	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Physics and Chemistry.
	PSO 2: To identify and understand the theoretical concepts of physical and chemical properties of materials and the role of mathematics in dealing with them in a quantitative way.
	PSO 3: To learn problem solving techniques related to Mathematics, Physics and Chemistry.
	PSO 4: To gain insights procedures of safe handling of Chemicals and Equipments.
	PSO 5: To carry out hands on experiments and to analyze results.
MPE	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Physics and Electronics.
	PSO 2: To identify and understand the mechanism behind various electronic and physical systems and quantify them with mathematical tools.
	PSO 3: To learn problem solving techniques related to Mathematics, Physics and Electronics.
	PSO 4: To gain skills needed to handle the instruments and design circuits with analysis of results.
MPCs	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Physics and Computer Science.
	PSO 2: To identify and understand the concepts of Mathematics, Physics and Computer Science and then relate them in numerical programming of physical system models.
	PSO 3: To learn problem solving techniques related to Mathematics, Physics and Computer Science.
	PSO 4: To gain skills required to develop programming techniques and implementation of numerical algorithms by using various programming languages.

MCPC	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Chemistry and Petro Chemicals.
	PSO 2: To identify and understand the theoretical concepts of Mathematics and Chemistry and utilize them in Petro Chemicals.
	PSO 3: To examine the Mathematical Modelling and Chemical procedures in the field of Petro chemicals.
	PSO 4: To get the employability skills in chemical industries as well as petro chemical industries.
MECs	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Electronics and Computer Science.
	PSO 2: To identify and understand the concepts of Mathematics and Computer Science and utilize them in numerical programming of electronical system models.
	PSO 3: To gain insights to design circuits and provide mathematical modelling.
	PSO 4: To design circuits and understand the variations by simulation.
MCCs	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Chemistry and Computer Science.
	PSO 2: To analyse the concepts of Mathematics, Chemistry and Computer Science and identify the relation among them like deriving the equations in chemistry, mathematical modelling of chemistry.
	PSO 3: To carry out problem solving and to demonstrate the real life applications of Mathematics and Chemistry in Computer Science.
	PSO 4: To gain insights procedures of safe handling of Chemicals and Equipment's.
MSCs	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Statistics and Computer Science.
	PSO 2: To identify and analyse the concepts of mathematics, statistics and computers science and then to find their applications in different areas like physical sciences, life sciences, various industries, etc.
	PSO 3: To solve various real life problems by developing mathematical model and applying various statistical tools with the help of computer programming knowledge.
	PSO 4: To develop thinking about research to solve critical problems.
MSAs	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Statistics and Actuarial Science.
	PSO 2: To identify and analyse the concepts of mathematics, statistics and Actuarial science and then to find their applications in different areas like physical sciences, life sciences, various industries, Insurance, etc.
	PSO 3: To solve various real life problems by developing mathematical model and applying various statistical tools with the help of suitable economic, finance and risk policies.
	PSO 4: To acquire the skill of collection of data, analyzing it and to give conclusions
	PSO 5: To develop thinking about research to solve critical problems.

MCAc	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Chemistry and Analytical Chemistry.
	PSO 2: To identify and understand the concepts of Mathematics, Chemistry and Analytical chemistry and then to understand the relation among them like mathematical modelling of chemistry and derivation of chemical equations.
	PSO 3: To gain insights procedures of safe handling of Chemicals and Equipments
	PSO 4: To get the employability skills especially chemical industries.
ME.IOT	PSO 1: To understand nature, scope, basic concepts and terminology of Mathematics, Electronics and Internet of thinking.
	PSO 2: To identify and understand the concepts of Mathematics and Electronics and utilize them in Internet programming system models.
	PSO 3: To gain insights to design networking.

**Courses (Papers) offered under B.Sc. Mathematics Stream**

<b>S. No.</b>	<b>Sem. No.</b>	<b>Domain Specific course/Clusters</b>	<b>Title</b>
1	I	Major	Essential and Applications of Mathematical, Physical and Chemical Sciences
2	I	Major	Advances in Mathematical, Physical and Chemical Sciences
3	I	For All First Year Major Students	Analytical Skills
4	II	Major & Minor	Differential Equations & Problem Solving Session
5	II	Major	Analytical Solid Geometry & Problem Solving Session
6	III	Major & Minor	Group Theory & Problem solving session
7		Major	Numerical Methods & Problem Solving Session
8		Major	Laplace Transforms & Problem Solving Session
9		Major	Special Functions & Problem Solving Sessions
10	IV	Major & Minor	Ring Theory & Problem Solving Session
11		Major & Minor	Introduction to Real Analysis & Problem Solving Session
12		Major	Integral Transforms & Problem Solving Session
13	V	Skill Enhancement Courses( Elective )	(To choose One pair from the Three alternate pairs ) Numerical Methods
			Mathematical Special Functions
			OR
			Multiple integrals and Applications of Vector Calculus
			Integral transforms with Applications

			OR
			Partial Differential Equations and Fourier Series
			Number theory

**MATHEMATICS COURSE OUTCOMES**


Year	Semester	Title of the Paper	Course Outcomes
I	II	Differential Equations	CO 1. solve first order first degree linear differential equations. CO 2. convert a non-exact homogeneous equation to exact differential equation by using an integrating factor CO 3. know the methods of finding solution of a differential equation of first order but not of first degree CO 4. solve higher-order linear differential equations for both homogeneous and non-homogeneous, with constant coefficients. CO 5. understand and apply the appropriate methods for solving higher order differential equations
	II	Analytical Solid Geometry	CO 1. understand planes and system of planes. CO 2. know the detailed idea of lines. CO 3. understand spheres and their properties. CO4. know system of spheres and coaxial system of spheres. CO 5. understand various types of cones.
II	III	Group Theory	CO 1. Acquire the basic knowledge and structure of groups. CO 2. Get the significance of the notation of a subgroup and cosets. CO 3. Understand the concept of normal subgroups and properties of normal subgroup. CO 4. Study the homomorphisms and isomorphisms with applications. CO 5. Understand the properties of permutation and cyclic groups.
	III	Numerical Methods	CO 1. Difference between the operators, $\Delta, \nabla, E$ and the relation between them. CO 2. Know about the Newton – Gregory

			<p>Forward and backward interpolation.</p> <p>CO3. Know the Central Difference operators, <math>\delta</math>, <math>\mu</math>, <math>\sigma</math> and relation between them.</p> <p>CO 4. Solve Algebraic and Transcendental equations.</p> <p>CO 5. Understand the concept of Curve fitting</p>
	III	Laplace Transforms	<p>CO 1. Understand the definition and properties of Laplace transformations</p> <p>CO 2. Get an idea about first and second shifting theorems and change of scale property.</p> <p>CO 3. Understand Laplace transforms of standard functions like Bessel, Error function etc.</p> <p>CO 4. Know the reverse transformation of Laplace and properties.</p> <p>CO 5. Get the knowledge of application of convolution theorem</p>
	III	Special Functions	<p>CO 1. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.</p> <p>CO 2. Find power series solutions of ordinary differential equations.</p> <p>CO 3. Solve Hermite equation and write the Hermite Polynomial of order (degree) <math>n</math>, also Find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.</p> <p>CO 4. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.</p> <p>CO 5. Solve Bessel equation and write the Bessel equation of first kind of order <math>n</math>, also find the generating function for Bessel function understand the orthogonal properties of Bessel unction.</p>
	IV	Ring Theory	<p>CO 1. Acquire the basic knowledge of rings, fields and integral domains.</p> <p>CO 2. Get the knowledge of subrings and ideals.</p> <p>CO 3. Construct composition tables for</p>

			<p>finite quotient rings.</p> <p>CO 4. Study the homomorphisms and isomorphisms with applications.</p> <p>CO 5. Get the idea of division algorithm of polynomials over a field.</p>
	IV	Introduction to Real Analysis	<p>CO1. Get clear idea about the real numbers and real valued functions.</p> <p>CO2. Obtain the skills of analysing the concepts and applying appropriate methods for testing convergence of a sequence/series.</p> <p>CO3. Test the continuity and differentiability and Riemann integration of a function.</p> <p>CO4. Know the geometrical interpretation of mean value theorems.</p> <p>CO 5. Know about the fundamental theorem of integral calculus.</p>
	IV	Integral Transforms	<p>CO 1. Understand the application of Laplace transforms to solve ODEs.</p> <p>CO 2. Understand the application of Laplace transforms to solve Simultaneous Des.</p> <p>CO 3. Understand the application of Laplace transforms to Integral equations.</p> <p>CO 4. Basic knowledge of Fourier-Transformations.</p> <p>CO 5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.</p>
III	V	Numerical Methods	<p>CO 1. Understand the subject of various numerical methods that are used to obtain approximate solutions .</p> <p>CO 2. Understand various finite difference concepts and interpolation methods.</p> <p>CO 3. Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.</p> <p>CO 4. Find numerical solutions of ordinary differential equations by using various numerical methods.</p> <p>CO 5. Analyze and evaluate the accuracy of numerical methods.</p>
		Mathematical Special Functions	<p>CO 1. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.</p>

			<p>CO 2. Find power series solutions of ordinary differential equations.</p> <p>CO 3. solve Hermite equation and write the Hermite Polynomial of order (degree) <math>n</math>, also find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.</p> <p>CO 4. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.</p> <p>CO 5. Solve Bessel equation and write the Bessel equation of first kind of order <math>n</math>, also find the generating function for Bessel function understand the orthogonal properties of Bessel unction.</p>
		OR	
		Multiple integrals and Applications of Vector Calculus	<p>CO 1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral / three variables in the case of triple integral.</p> <p>CO 2. Learn applications in terms of finding surface area by double integral and volume by triple integral.</p> <p>CO 3. Determine the gradient, divergence and curl of a vector and vector identities.</p> <p>CO 4. Evaluate line, surface and volume integrals.</p> <p>CO 5. understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem).</p>
		Integral transforms with Applications	<p>CO 1. Evaluate Laplace transforms of certain functions, find Laplace transforms of derivatives and of integrals.</p> <p>CO 2. Determine properties of Laplace transform which may be solved by application of special functions namely Dirac delta function, error function, Bessel function and periodic function.</p> <p>CO 3. Understand properties of inverse</p>

		<p>Laplace transforms, find inverse Laplace transforms of derivatives and of integrals.</p> <p>CO 4. Solve ordinary differential equations with constant/ variable coefficients by using Laplace transform method.</p> <p>CO 5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.</p>
	OR	
	Partial Differential Equations and Fourier Series	<p>CO 1. Classify partial differential equations, formation of partial differential equations and solve Cauchy's problem for first order equations.</p> <p>CO 2. Solve Lagrange's equations by various methods, find integral Surface passing through a given curve and Surfaces orthogonal to a given system of Surfaces.</p> <p>CO 3. Find solutions of nonlinear partial differential equations of order one by using Char pit's method.</p> <p>Co 4. Find solutions of nonlinear partial differential equations of order one by using Jacobi's method.</p> <p>CO 5. Understand Fourier series expansion of a function <math>f(x)</math> and Parseval's theorem.</p>
	Number theory	<p>CO 1. Find quotients and remainders from integer division, study divisibility properties of integers and the distribution of primes.</p> <p>CO 2. Understand Dirichlet multiplication which helps to clarify interrelationship between various arithmetical functions.</p> <p>CO 3. Comprehend the behaviour of some arithmetical functions for large <math>n</math>.</p> <p>CO 4. Understand the concepts of congruencies, residue classes and complete residues systems.</p> <p>CO 5. Comprehend the concept of quadratic residues mod <math>p</math> and quadratic non residues mod <math>p</math>.</p>

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program&amp;Semester</b>  FOR ALL MAJOR SUBJECTS (I Sem)			
CourseCode  <b>MAT 101</b>	<b>TITLE OF THE COURSE</b>  <b>ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES</b>				
Teaching	HoursAllocated:60( <b>Theory</b> )	L	T	P	C
Pre-requisites:		5	-	-	4

### **Course Objective:**

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.
2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations
3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.
- 5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

### **UNIT I: ESSENTIALS OF MATHEMATICS:**

Complex Numbers: Introduction of the new symbol  $i$  – General form of a complex number – Modulus- Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles.

Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems.

Statistical Measures: Mean, Median, Mode of a data and problems.

### **UNIT II: ESSENTIALS OF PHYSICS:**

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

### **UNIT III: ESSENTIALS OF CHEMISTRY:**

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

### **UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:**

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis.

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

### **UNIT V: ESSENTIALS OF COMPUTER SCIENCE:**

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

### **Recommended books:**

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and

John W. Jewett Jr.

8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman

**PITHAPURRAJAH'S GOVERNMENT COLLEGE(A), Kakinada**

**Blue print for the model paper –Mathematics**

S.No.	Type of question	Given in the Question paper			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	6	10	60	3	10	30
2	Section – B Short answer Question	7	5	35	4	5	20
<b>TOTAL</b>		13		95	07		50

**BluePrint**

Module	Essay Questions 10marks	Short Questions 5marks	Marks allotted
I	1	2	20
II	1	1	15
III	1	2	20
IV	2 (M, P)	1 ( C )	25
V	1	1	20
			<b>95</b>

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**SEMESTER – I**

**COURSE - I**

**Time: 2 Hours**

**Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks.**

**3 X 10 = 30M**

**Part – A**

1. Long Answer Question 1
2. Long Answer Question 2
3. Long Answer Question 3

**Part - B**

4. Long Answer Question 4
5. Long Answer Question 5
6. Long Answer Question 6

**Section II**

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Short Answer Question 7
8. Short Answer Question 8
9. Short Answer Question 9
10. Short Answer Question 10
11. Short Answer Question 11
12. Short Answer Question 12
13. Short Answer Question 13

## STUDENT ACTIVITIES

### UNIT I: ESSENTIALS OF MATHEMATICS:

#### 1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties

#### 2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

#### 3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

#### 4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyze the central tendencies and distribution of the data.

### UNIT II: ESSENTIALS OF PHYSICS:

#### 1. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

#### 2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

### UNIT III: ESSENTIALS OF CHEMISTRY

### 1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

### 2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

### 3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.

Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

### 4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.

Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

## **UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

### 1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

### 2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

### 3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.


Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

### .4: Mathematical Modeling

Present students with real-world problems that require mathematical modeling and analysis.

## **UNIT V: ESSENTIALS OF COMPUTER SCIENCE:**

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of your college network) and prepare a report covering network architecture.
2. Identify the types of malwares and required firewalls to provide security.
3. Latest Fraud techniques used by hackers.

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program&amp;Semester</b>  FOR ALL MAJOR SUBJECTS (I Sem)			
CourseCode  <b>MAT 102</b>	<b>TITLE OF THE COURSE ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES</b>				
Teaching	HoursAllocated:60( <b>Theory</b> )	L	T	P	C
Pre-requisites:		5	-	-	4

### **Course Objective:**

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

### **Learning outcomes:**

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.
2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.
3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.
3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

#### **UNIT I: ADVANCES IN BASICS MATHEMATICS**

Straight Lines: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

#### **UNIT II: ADVANCES IN PHYSICS:**

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

#### **UNIT III: ADVANCES IN CHEMISTRY:**

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

#### **UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine.

Solid waste management, Environmental remediation- Green Technology, Water treatment.

#### **UNIT V: Advanced Applications of computer Science**

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

#### **Recommended books:**

1. Coordinate Geometry by S.L.Lony, Arihant Publications

2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.

**PITHAPURRAJAH'S GOVERNMENT COLLEGE(A), Kakinada**

**Blue print for the model paper –Mathematics**

S.No.	Type of question	Given in the Question paper			To be answered		
		No. of Questions	Marksal lottedTo each question	Totalm arks	No. of Questions	Marksal lottedTo each question	Totalm arks
1	Section – A Essay question	6	10	60	3	10	30
2	Section – B Short answer Question	7	5	35	4	5	20
<b>TOTAL</b>		13		95	07		50

**BluePrint**

Module	Essay Questions 10marks	Short Questions 5marks	Marks allotted
I	1	2	20
II	1	1	15
III	1	2	20
IV	2 (M, P)	1 ( C )	25
V	1	1	20
			<b>95</b>

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**SEMESTER – I**

**COURSE - II**

**Time: 2 Hours**

**Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks.**

**3 X 10 = 30M**

**Part – A**

1. Long Answer Question 1
2. Long Answer Question 2
3. Long Answer Question 3

**Part - B**

4. Long Answer Question 4
5. Long Answer Question 5
6. Long Answer Question 6

**Section II**

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Short Answer Question 7
8. Short Answer Question 8
9. Short Answer Question 9
10. Short Answer Question 10
11. Short Answer Question 11
12. Short Answer Question 12
13. Short Answer Question 13

## STUDENT ACTIVITIES

### UNIT I: ADVANCES IN BASIC MATHEMATICS

#### 1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

#### 2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analyzing rates of change or optimizing functions.

#### 3: Integration Exploration

Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry

#### 4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

### UNIT II: ADVANCES IN PHYSICS:

#### 1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.

They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.

#### 2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field.

### **3: Group Discussion and Debate**

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

## **UNIT III: ADVANCES IN CHEMISTRY:**

### **1. Experimental Design and Simulation**

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.

Chemical biology-related activities could involve designing experiments to study enzyme- substrate interactions or molecular interactions in biological systems.

Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

### **2. Case Studies and Discussion**

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.

Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.

For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

### **3: Group Project**

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.

Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

## **UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

### **1: Mathematical Modelling Experiment**

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.

Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.

They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

### **2: Case Studies and Group Discussions**

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.

Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

### **3. Group Project**

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.


The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices.

Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

### **UNIT V: Advanced Applications of computer Science**

1. Students must be able to convert numbers from other number system to binary number systems
2. Identify the networking media used for your college network
3. Identify all the networking devices used in your college premises.

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program&amp;Semester</b>  FOR ALL MAJOR SUBJECTS (I Sem)			
CourseCode	<b>TITLE OF THE COURSE</b>  Analytical Skills				
Teaching	HoursAllocated:30( <b>Theory</b> )	L	T	P	C
Pre-requisites:	Critical thinking and Communication skills	2	-	-	2

### Course Objectives:

Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
CO2	Acquire competency in the use of verbal reasoning.
CO3	Apply the skills and competencies acquired in the related areas.
CO4	Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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#### UNIT – 1

(10 Hrs)

#### Arithmetic ability:

**Algebraic operations BODMAS, Fractions, Divisibility rules, LCM& GCD(HCF).**

#### Verbal Reasoning:

**Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.**

#### UNIT – 2:

(10 Hrs)

#### Quantitative aptitude:

**Averages, Ratio and proportion, Problems on ages, Time-distance–speed.**

#### Business computations:

**Percentages, Profit & loss, Partnership, simple compound interest.**

**UNIT – 3:**

(07 Hrs)

**Data Interpretation:****Tabulation, Bar Graphs, Pie Charts, line Graphs. Venn diagrams.****Recommended Co-Curricular Activities**

(03 Hrs)

Surprise tests / Viva-Voice / Problem solving/Group discussion.

**Text Book:**

Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.

**Reference Books:**

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw Hill Publication

**CO-PO Mapping:**

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	3	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	2	3	3	1	1	3	1	2

**BLUE PRINT FOR QUESTION PAPER PATTERN  
SEMESTER-I**

<b>Unit</b>	<b>TOPIC</b>	<b>Multiple choice questions ( 1 mark )</b>	<b>S.A.Q</b>	<b>Marks allotted to the Unit</b>
I	Arithmetic ability & Verbal reasoning	10	2	20
II	Quantitative aptitude & Business computations	10	2	20
III	Data interpretation	10	2	20
	<b>TOTAL</b>	<b>30</b>	<b>6</b>	<b>60</b>

**M.C.Q.** = multiple choice questions (1 marks)

**S.A.Q** = Short answer questions ( 5 Marks )

Very Short answer questions : 30 x 1 = 30M

Short answer questions : 4 x 5 = 20 M

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Total Marks = 50M

**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**I year Degree Examinations - I Semester**  
**Foundation course: Analytical Skills**  
**(Model Paper w.e.f. 2023-24)**

**Time: 2 Hrs**

**Total Marks: 50M**

**Section-A**

**Answer the following Questions. Each question carries one mark.**

**30 x 1 = 30 M**

1.  $25 - [18 - \{25 + 3(10 - \overline{7 - 5})\}] = ?$

- a) **86**                      b) 68                      c) 52                      d) None of these

2. Which of the following fraction is arranged in ascending order of their value ?

- a)  $1/4, 2/7, 3/4, 4/7, 5/7, 6/5$       b)  **$1/4, 2/7, 4/7, 5/7, 3/4, 6/5$**   
c)  $2/7, 1/4, 4/7, 3/4, 5/7, 6/5$       d)  $2/7, 1/4, 4/7, 5/7, 3/4, 6/5$

3. If HCF, LCM of two numbers are 16, 240. If one number is 48, find the other ?

- a) 58                      b) **80**                      c) 85                      d) 72

4.  $(x^n - a^n)$  is completely divisible by  $(x - a)$ , when

- a) **n is any natural number**                      b) n is an even natural number  
c) n is an odd natural number                      d) n is prime

5. 11, 13, 17, 19, 23, 25, ?

- a) 26                      b) 27                      c) **29**                      d) 37

6. A and B are young ones of C. If C is the father of A but B is not the son of C. How are B and C related

- a) niece and Uncle      b) **Daughter and Father**      c) Niece and Father      d) Daughter and Mother

7. In certain code 'FROZEN' is written as 'OFAPSG'. How is 'MOLTEN' is written in that code?

- a) OFPOMN                      b) OFSMPN                      c) **OFUMPN**                      d) OFUNPM

8. How many times do the hands of a clock coincide in a day ?

- a) 24                      b) 21                      c) 20                      d) **22**

9. What was the day India attained Independence ?

- a) Wednesday                      b) **Friday**                      c) Monday                      d) Thursday

10. Today is Tuesday. After 62 days it will be

- a) **Monday**                      b) Wednesday                      c) Tuesday                      d) Friday

11. What will be the average of numbers from 1 to 51.

- a) 25                      b) **26**                      c) 27                      d) 28

12. The average age of 14 girls and their teacher's age is 15 yr. If teacher's age is excluded, then the average reduced by 1. What is the teacher's age ?

- a) **29 yr**                      b) 35 yr                      c) 32 yr                      d) 30 yr

13. The sum of three consecutive odd numbers is 285 . What is the ratio of the smallest and largest numbers respectively ?

- a) 97 : 95                      b) 93 : 95                      c) 95 : 93                      d) **93 : 97**

14. The ages of Surekha and Arunima are in the ratio of 9 : 8 respectively . After 5 yr , the ratio of their ages will be 10 : 9 . what is the difference in years between their ages ?

- a) 4 yr                      b) **5 yr**                      c) 6 yr                      d) 7 yr

15. If a student walks from his house to school at 5 km / h , he is late by 30 min . However , if he walks at 6 km / h , he is late by 5 min only . The distance of his school from his house is

- a) 2.5 km                      b) **12.5 km**                      c) 3.6 km                      d) 5.5 km

16. Raman scored 456 marks in an exam and Sita got 54% marks in the same exam , which is 24 marks less than Raman . If the minimum passing marks in the exam is 34% , then how much more marks did Raman score than the minimum passing marks ?

- a) **184**                      b) 196                      c) 190                      d) 180

17. By selling 18 chocolates , a vendor loses the selling price of 2 chocolates . Find his loss per cent .

- a) 95                      b) **10%**                      c) 11%                      d) 12%

18. A , B and C invested their capitals in the ratio of 5 : 6 : 8 . At the end of the business , they received the profits in the ratio of 5 : 3 : 1 . Find the ratio of time for which they contributed their capitals .

- a) 12 : 9 : 7                      b) 25 : 18 : 8                      c) 5 : 6 : 8                      d) **8 : 4 : 1**

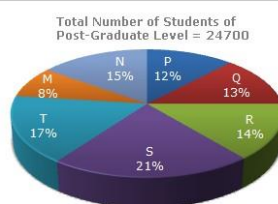
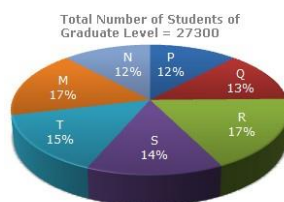
19. The compound interest accrued on an amount at the end of 2 yr at the rate of 12% p.a. is Rs.2862 . What is the amount ?

- a) **Rs.11250**                      b) Rs.12200                      c) Rs.13500                      d) Rs. 10000

20. A sum of Rs.3200 becomes Rs.3456 in 2 yr at a certain rate of simple interest . What is the rate of interest per annum ?

- a) 5.5%                      b) 6%                      c) **4%**                      d) 4.5%

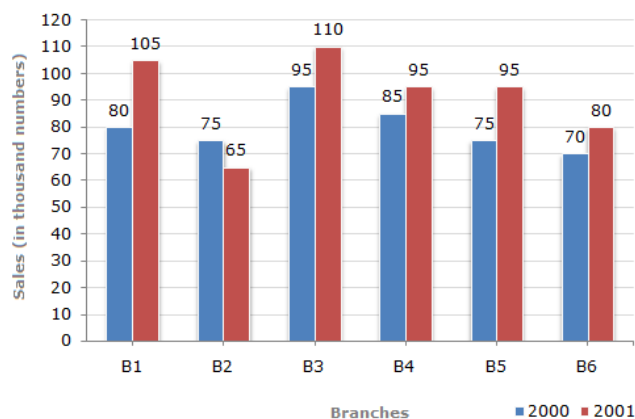
21. The following pie-charts show the distribution of students of graduate and post-graduate levels in seven different institutes in a town. **Distribution of students at graduate and post-graduate levels in seven institutes:**



1. What is the total number of graduate and post-graduate level students in institute R?  
A. 8320                      B. 7916                      C. 9116                      **D. 8099**
2. What is the ratio between the number of students studying at post-graduate and graduate levels respectively from institute S?  
A. 14:19                      B. 19:21                      C. 17:21                      **D. 19:14**
3. How many students of institutes of M and S are studying at graduate level?  
A. 7516                      **B. 8463**                      C. 9127                      D. 9404
4. What is the ratio between the number of students studying at post-graduate level from institutes S and the number of students studying at graduate level from institute Q?  
A. 13:19                      B. 21:13                      C. 13:8                      **D. 19:13**
5. Total number of students studying at post-graduate level from institutes N and P is  
A. 5601                      B. 5944                      **C. 6669**                      D. 8372

22. The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years 2000 and 2001.

**Sales of Books (in thousand numbers) from Six Branches - B1, B2, B3, B4, B5 and B6 of a publishing Company in 2000 and 2001.**



1. What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?  
A. 2:3                      B. 3:5                      C. 4:5                      **D. 7:9**
2. Total sales of branch B6 for both the years is what percent of the total sales of branches B3 for both the years?  
A. 68.54%                      B. 71.11%                      **C. 73.17%**                      D. 75.55%
3. What percent of the average sales of branches B1, B2 and B3 in 2001 is the average sales of branches B1, B3 and B6 in 2000?  
A. 75%                      B. 77.5%                      C. 82.5%                      **D. 87.5%**
4. What is the average sales of all the branches (in thousand numbers) for the year 2000?  
A. 73                      **B. 80**                      C. 83                      D. 88
5. Total sales of branches B1, B3 and B5 together for both the years (in thousand numbers) is ?  
A. 250                      B. 310                      C. 435                      **D. 560**

## SECTION – B

Answer any four questions . Each question carries 5 Marks .

4 x 5 = 20 M

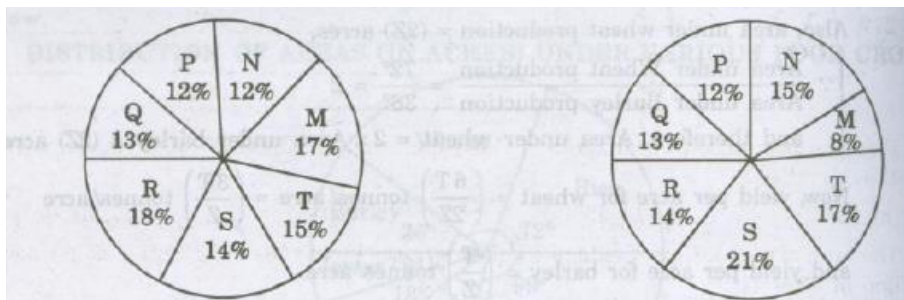
1. Explain the divisibility rules .
2. Explain the BODMAS rule.
3. Explain the types of Ratio and Proportion .
4. Explain simple and compound interest .
5. Explain the Venn diagrams .

6. *The following pie-charts show the distribution of students of graduate and post graduate levels in seven different institute-M,N,P,Q,R,S and T in a town.*


### DISTRIBUTION OF STUDENTS AT GRADUATE AND POST-GRADUATE LEVELS IN SEVEN INSTITUTES-M,N,P,Q,R,S AND T.

**Total Number of students of  
graduate level 27300**

**Total Number of students of  
post graduate level 24700**



1. How many students of institutes M and S are studying at graduate level?
2. Total number of students studying at post -graduate level from institutes N and P is:
3. What is the total number of graduate and post-graduate level students in institute R?
4. What is the ratio between the number of students studying at post graduate and graduate levels respectively from institute S?
5. What is the ratio between the number of students studying post graduate level from institute S and the number of students studying at graduate level from institute Q?

	<b>P.R. Government College (Autonomous): KAKINADA</b>	<b>Program &amp; Semester</b> I B.Sc Major & Minor (II Sem) w.e.f. 2023-24 admitted Batch			
Course Code MAT-201	<b>TITLE OF THE COURSE</b> <b>Differential Equations &amp; Problem Solving Session</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Calculus and Linear Algebra	3	-	-	3

### Course Objectives:

To provide students with an introduction to the theory of ordinary differential equations through applications, methods of solution, and numerical approximations.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Solve linear differential equations
C02	Convert non - exact homogeneous equations to exact differential equations by using integrating factors.
C03	Know the methods of finding solutions of differential equations of the first order but not of the first degree.
C04	Understand the concept and apply appropriate methods for solving differential equations.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### COURSE SYLLABUS:

#### UNIT – I: Differential Equations of first order and first degree

Linear Differential Equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors, Equations reducible exact equations by integrating factors:

1. Inspection Method
2.  $1 / Mx + Ny$
3.  $1 / Mx - Ny$

## **UNIT – II: Orthogonal Trajectory and Differential Equations of first order but not of the first degree**

### **Differential Equations of first order but not of the first degree :**

Equations solvable for  $p$ ; Equations solvable for  $y$ , Equations solvable for  $x$  - Clairaut's Equation.

Orthogonal trajectories : Cartesian and polar co- ordinates.

## **UNIT – III: Higher order linear differential equations**

Solution of homogeneous linear differential equations of order  $n$  with constant coefficients;  
Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.

P.I. of  $f(D)y = Q$  when  $Q = e^{ax}$

P.I. of  $f(D)y = Q$  when  $Q$  is  $b \sin ax$  or  $b \cos ax$ .

## **UNIT – IV: Higher order linear differential equations (continued)**

Solution of the non-homogeneous linear differential equations with constant coefficients. P.I. of  $f(D)y = Q$  when  $Q = bx^k$

P.I. of  $f(D)y = Q$  when  $Q = be^{ax} V$

P.I. of  $f(D)y = Q$  when  $Q = xV$

## **UNIT –V: Higher order linear differential equations with non-constant coefficients**

Linear differential equations with non-constant coefficients : The Cauchy-Euler Equation ;Legendre's Equations, Method of variation of parameters.

### **Activities**

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving Sessions.

### **Text Book**

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

### **Reference Books**

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand &Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.

3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University

Press.

**Additional Inputs :**

Total Differential Equations

**CO-POMapping:**

**(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-' :NoCorrelation)**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PS01	PS02	PS03
C01	3	3	2	3	3	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	2	3	3	1	1	3	1	2

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**COURSE-IV- DIFFERENTIAL EQUATIONS**

<b>Unit</b>	<b>TOPIC</b>	<b>S.A.Q</b>	<b>E.Q</b>	<b>Marks allotted to the Unit</b>
I	Differential Equations of first order and first degree	2	2	20
II	Orthogonal Trajectory and Differential Equations of first order but not of the first degree	2	1	20
III	Higher order linear differential equations	1	1	15
IV	Higher order linear differential equations (continued)	1	1	15
V	Higher order linear differential equations with non-constant coefficients	1	1	15
<b>Total</b>		7	6	95

**S.A.Q.** = Short answer questions (5 marks)

**E.Q** = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

.....  
Total Marks = 50 M

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I year B.Sc., Degree Examinations - II Semester**

**Mathematics Course-IV: Differential Equations**

**(w.e.f. 2024-25 Admitted Batch)**

**Model Paper (w.e.f. 2024-2025)**

**Time: 2 Hours**

**Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt atleast one question from each part.**

**Each question carries 10 Marks.**

**3 X 10 = 30M**

**Part – A**

1. Essay question from unit – I.
2. Essay question from unit – I
3. Essay question from unit – II.


**Part - B**

4. Essay question from unit - III.
5. Essay question from unit – IV.
6. Essay question from unit - V.

**Section II**

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Short answer question from unit - I
8. Short answer question from unit - I.
9. Short answer question from unit - II.
10. Short answer question from unit - II.
11. Short answer question from Unit - III.
12. Short answer question from unit - IV.
13. Short answer question from unit - V.

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  I B.Sc Major & Minor (II Sem)  w.e.f.2023-24 admitted Batch			
	Course Code  MAT-201P	<b>TITLE OF THE COURSE</b>  <b>Differential Equations &amp; Problem Solving Sessions Practical Course</b>			
Teaching	Hours Allocated:30( <b>Practical's</b> )	L	T	P	C
Pre-requisites:	Calculus and Linear Algebra	-	-	2	1

### UNIT – I: Differential Equations of first order and first degree

Linear Differential Equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors, Equations reducible exact equations by integrating factors:

1. Inspection Method    2.  $1 / Mx + Ny$     3.  $1 / Mx - Ny$

### UNIT – II: Orthogonal Trajectory and Differential Equations of first order but not of the first degree

#### Differential Equations of first order but not of the first degree :

Equations solvable for p; Equations solvable for y, Equations solvable for x - Clairaut's Equation. Orthogonal trajectories : Cartesian and polar co- ordinates.

### UNIT – III: Higher order linear differential equations

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.

P.I. of  $f(D)y = Q$  when  $Q = e^{ax}$

P.I. of  $f(D)y = Q$  when  $Q$  is  $b \sin ax$  or  $b \cos ax$ .

### UNIT – IV: Higher order linear differential equations (continued)

Solution of the non-homogeneous linear differential equations with constant coefficients.

P.I. of  $f(D)y = Q$  when  $Q = bx^k$

P.I. of  $f(D)y = Q$  when  $Q = be^{ax} V$

P.I. of  $f(D)y = Q$  when  $Q = xV$

## **UNIT –V: Higher order linear differential equations with non-constant coefficients**

Linear differential equations with non-constant coefficients : The Cauchy-Euler Equation ;Legendre's Equations, Method of variation of parameters.

### **Text Book**

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

### **Reference Books**

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand &Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

**BLUE PRINT FOR PRACTICAL PAPER PATTERN**  
**COURSE-IV- DIFFERENTIAL EQUATIONS**

<b>Unit</b>	<b>TOPIC</b>	<b>E.Q</b>	<b>Marks allotted to the Unit</b>
I	Differential Equations of first order and first degree	2	12
II	Orthogonal Trajectory and Differential Equations of first order but not of the first degree	2	12
III	Higher order linear differential equations	1	06
IV	Higher order linear differential equations (continued)	2	12
V	Higher order linear differential equations with non-constant coefficients	1	06
<b>Total</b>		08	48

**Semester – I End Practical Examinations**  
**Scheme of Valuation for Practical's**

**Time : 2 Hours**

**Max. Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**

**Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I year B.Sc., Degree Examinations - II Semester**

**Mathematics Course-III: Differential Equations**

**(w.e.f. 2024-25 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**

**SECTION - A**


1. Essay question from unit – I
2. Essay question from unit – I.
3. Essay question from unit - II
4. Essay question from unit – II

**SECTION - B**

5. Essay question from unit - III.
6. Essay question from unit – IV.
7. Essay question from unit – IV.
8. Essay question from unit - V.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b> I B.Sc Major (II Sem) w.e.f. 2023-24 admitted Batch			
Course Code MAT-202 T	<b>TITLE OF THE COURSE</b> <b>Analytical Solid Geometry &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on 2-D Geometry	3	-	-	3

### Course Objectives:

The student will demonstrate knowledge of geometry and its applications in the real world.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Get the knowledge of planes.
C02	Basic idea of lines, sphere and cones.
C03	Understand the properties of planes, lines, spheres and cones.
C04	Express the problems geometrically and then to get the solution.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### COURSE SYLLABUS:

#### UNIT – I: The Plane

Equation of plane in terms of its intercepts on the axis - Equations of the plane through the given points - Length of the perpendicular from a given point to a given plane - Bisectors of angles between two planes - Combined equation of two planes .

#### UNIT – II: The Line

Equation of a line - Angle between a line and a plane - The condition that a given line may lie in a given plane - The condition that two given lines are coplanar - The shortest distance between two lines - The length and equations of the line of shortest distance between two straight lines - Length of the perpendicular from a given point to a given line.

### **UNIT – III: The Sphere**

Definition and equation of the sphere - Equation of the sphere through four given points - Plane sections of a sphere - Intersection of two spheres - Equation of a circle - Sphere through a given circle - Intersection of a sphere and a line - Power of a point - Tangent plane - Plane of contact; Polar plane - Pole of a Plane - Conjugate points - Conjugate planes.

### **UNIT – IV: The Sphere**

Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical plane; Coaxial system of spheres.

### **UNIT –V: Cones**

Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertex and guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone - Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle.

### **Co-Curricular Activities:**

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving Sessions.

### **Prescribed Text Book:**

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

### **Reference Books :**

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. 2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. 3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

**Additional Inputs :** Definition of Cylinder and Right Circular Cylinder .

**CO-POMapping:**

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PS01	PS02	PS03
C01	3	3	2	3	2	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	1	2	3	2	2	3
C04	3	2	3	2	1	2	3	3	1	2	3	1	2

**BLUE PRINT FOR QUESTION PAPER PATTERN**

**COURSE-IV- ANALYTICAL SOLID GEOMETRY**

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	The Plane	1	1	15
II	The Line	1	2	25
III	The Sphere	2	1	20
IV	The Sphere	1	1	15
V	Cones	2	1	20
		7	6	95

**S.A.Q.** = Short answer questions (5 marks)

**E.Q** = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M  
.....

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I year B.Sc., Degree Examinations - II Semester**

**Mathematics Course-IV: Analytical Solid Geometry**

**(w.e.f. 2024-25 Admitted Batch)**

**Model Paper (w.e.f. 2024-2025)**

**Time: 2Hrs**

**Max. Marks: 50M**

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**Section -I**

**Answer any three of the following questions. Must attempt atleast one question from each part.**

**Each question carries 10 Marks.**

**3 X 10 = 30M**

**Part – A**

1. Essay question from unit - I.
2. Essay question from unit - II.
3. Essay question from unit - II.


**Part - B**

4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

**Section II**

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Short answer question from unit - I.
8. Short answer question from unit - II.
9. Short answer question from unit – III.
10. Short answer question from unit - III.
11. Short answer question from unit - IV.
12. Short answer question from unit – V.
13. Short answer question from unit – V.

	<b>P.R. Government College (Autonomous): KAKINADA</b>	<b>Program &amp; Semester</b> I B.Sc Major (II Sem) w.e.f 2023-24 admitted batch					
CourseCode MAT-202 P	<b>TITLE OF THE COURSE</b> <b>Analytical Solid Geometry &amp; Problem Solving Sessions Practical Course</b>						
Teaching	HoursAllocated:30( <b>Practical</b> )			L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on 2-D Geometry			-	-	2	1

### UNIT – I: The Plane

Equation of plane in terms of its intercepts on the axis - Equations of the plane through the given points - Length of the perpendicular from a given point to a given plane - Bisectors of angles between two planes - Combined equation of two planes .

### UNIT – II: The Line

Equation of a line - Angle between a line and a plane - The condition that a given line may lie in a given plane - The condition that two given lines are coplanar - The shortest distance between two lines - The length and equations of the line of shortest distance between two straight lines - Length of the perpendicular from a given point to a given line.

### UNIT – III: The Sphere

Definition and equation of the sphere - Equation of the sphere through four given points - Plane sections of a sphere - Intersection of two spheres - Equation of a circle - Sphere through a given circle - Intersection of a sphere and a line - Power of a point - Tangent plane - Plane of contact; Polar plane - Pole of a Plane - Conjugate points - Conjugate planes.

### UNIT – IV: The Sphere

Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical plane; Coaxial system of spheres.

### UNIT –V: Cones

Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertex and guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone - Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle.

**Prescribed Text Book:**

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd.  
7th Edition.

**Reference Books :**

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

**Semester – II End Practical Examinations****Scheme of Valuation for Practical's****Time : 2 Hours****Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

**BLUE PRINT FOR PRACTICAL PAPER PATTERN****COURSE-IV- ANALYTICAL SOLID GEOMETRY**

<b>Unit</b>	<b>TOPIC</b>	<b>E.Q</b>	<b>Marks allotted to the Unit</b>
I	<b>The Plane</b>	2	12
II	<b>The Line</b>	2	12
III	<b>The Sphere-I</b>	1	6
IV	<b>The Sphere - II</b>	1	12
V	<b>Cones</b>	2	6
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**I year B.Sc., Degree Examinations - II Semester**

**Mathematics Course-IV: Analytical Solid Geometry**

**(w.e.f. 2024-25 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**

**SECTION - A**


1. Essay question from unit - I
2. Essay question from unit - II.
3. Essay question from unit - II.
4. Essay question from unit - II.

**SECTION -B**

5. Essay question from unit - III.
6. Essay question from unit - IV.
7. Essay question from unit – V.
8. Essay question from unit – V.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b> II B.Sc Major & Minor (III Sem) w.e.f 2023-24 admitted batch			
Course Code <b>MAT - 301 T</b>	<b>TITLE OF THE COURSE</b> <b>Group Theory &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets and number system.	3	1	-	4

### Course Objectives:

To provide the learner with the skills, knowledge and competencies to carry out their duties and responsibilities in pure Mathematic environment.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Acquire the basic knowledge and structure of groups
C02	Get the significance of the notation of a subgroup and cosets.
C03	Understand the concept of normal subgroups and properties of normal subgroup, permutation and cyclic groups.
C04	Study the homomorphisms and isomorphisms with applications.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### UNIT I :

**GROUPS** : Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

### UNIT II:

**SUBGROUPS**: Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups; Criterion for the product

of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – properties of Cosets – Index of a subgroups of a finite groups – Lagrange’s Theorem.

### UNIT III:

#### NORMAL SUBGROUPS:

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup– Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups Sub group of index 2 is a normal sub group.

### UNIT IV

#### HOMOMORPHISM:

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

### UNIT V:

#### PERMUTATIONS AND CYCLIC GROUPS:

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley’s theorem.

Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

### Co-Curricular Activities

Seminar/ Quiz/ Assignments/ Group theory and its applications / Problem Solving.

### TEXT BOOK:

Modern Algebra by A.R.Vasishtha and A.K.Vasishtha, KrishnaPrakashanMedia Pvt. Ltd., Meerut.

### REFERENCE BOOKS :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

### CO-POMapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	3	2	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	2	3	3	1	1	3	1	2

## BLUE PRINT FOR QUESTION PAPER PATTERN

### SEMESTER-III

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Groups	2	1	20
II	Subgroups , Co-sets and Lagrange's Theorem	2	1	20
III	Normal subgroups	1	1	15
IV	Homomorphism	1	1	15
V	Permutations and Cyclic Groups	1	2	25
<b>Total</b>		<b>7</b>	<b>6</b>	<b>95</b>

**S.A.Q.** = Short answer questions (5 marks)

**E.Q** = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M

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**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**II year B.Sc., Degree Examinations - III Semester**  
**Mathematics Course V: Abstract Algebra**  
**Model Paper( w.e.f. 2024-25)**

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**Time: 2Hrs**

**Max. Marks: 50**

**SECTION-A**

Answer any three questions. Selecting at least one question from each part

Part – I

3 X 10 = 30

1. Essay question from Unit -I.
2. Essay question from Unit – II.
3. Essay question from Unit - III.

**Part – II**


4. Essay question from Unit – IV.
5. Essay question from Unit – V.
6. Essay question from Unit - V.

**SECTION-B**

**Answer any four questions**

**4 X 5 M = 20 M**

7. Short answer question from Unit - I.
8. Short answer question from Unit – I.
9. Short answer question from Unit – II.
10. Short answer question from Unit - II.
11. Short answer question from Unit - III.
12. Short answer question from Unit -IV.
13. Short answer question from Unit - V.

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b> II B.Sc Major & Minor (III Sem) w.e.f 2023-24 admitted batch			
Course Code MAT-301P	<b>TITLE OF THE COURSE</b> <b>Group Theory &amp; Problem Solving Sessions Practical Course</b>				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets and number system.	-	-	2	1

### UNIT I :

**GROUPS** : Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

### UNIT II:

**SUBGROUPS**: Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups; Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – properties of Cosets – Index of a subgroups of a finite groups – Lagrange's Theorem.

### UNIT III:

#### **NORMAL SUBGROUPS:**

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup– Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups Sub group of index 2 is a normal sub group

### UNIT IV

#### **HOMOMORPHISM:**

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

### UNIT V:

#### **PERMUTATIONS AND CYCLIC GROUPS:**

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

**TEXT BOOK :**

Modern Algebra by A.R.Vasishtha and A.K.Vasishtha, KrishnaPrakashanMedia Pvt. Ltd., Meerut.

**REFERENCE BOOKS :**

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

**Semester – III End Practical Examinations****Scheme of Valuation for Practical's**

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

**BLUE PRINT FOR PRACTICAL PAPER PATTERN****COURSE-V- ABSTRACT ALGEBRA**

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Groups	1	06
II	Sub groups Co-sets and Lagrange's Theorem	2	12
III	Normal subgroups	2	12
IV	Homomorphism	1	06
V	Permutations and Cyclic Groups	2	12
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**II year B.Sc., Degree Examinations - III Semester**

**Mathematics Course-V: ABSTRACT ALGEBRA**

**(w.e.f. 2023-24 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**


**SECTION - A**

1. Unit - I.
2. Unit – II.
3. Unit - II.
4. Unit – III.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - V.
8. Unit - V.

- **Record - 10 Marks**
- **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc Major (III Sem) w.e.f 2023-24 admitted batch			
Course Code MAT-302 T	<b>TITLE OF THE COURSE</b>  <b>Numerical Methods &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Advanced Calculus, Linear Algebra and Differential Equations	3	1	-	4

### Course Objectives:

This course will cover the classical fundamental topics in numerical methods such as, approximation, finite differences, Interpolation with equal and unequal intervals, solution of Algebraic and Transcendental equations and Curve fitting.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Difference between the operators, $\Delta$ , $\nabla$ , $E$ and the relation between them.
C02	Know about the Newton – Gregory Forward and backward interpolation, Central Difference operators, $\delta$ , $\mu$ , $\sigma$ and relation between them
C03	Solve Algebraic and Transcendental equations.
C04	Understand the concept of Curve fitting.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### Unit – 1:

#### The calculus of finite differences

The operators,  $\Delta$ ,  $\nabla$ ,  $E$  - Fundamental theorem of difference calculus- properties of,  $\Delta$ ,  $\nabla$ ,  $E$  and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between  $E$  and  $D$  - relation between  $D$  and  $\Delta$  - problems on one or more

missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

### **Unit – 2: Interpolation with Equal and Unequal intervals**

Derivations of Newton – Gregory Forward and backward interpolation and problems on them.

Divided differences - Newton divided difference formula - Lagrange's and problems on them.

### **Unit – 3: Central Difference Interpolation formulae**

Central Difference operators,  $\delta$ ,  $\mu$ ,  $\sigma$  and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirlings formula - Bessel's formula and problems on the above formulae.

### **Unit – 4: Solution of Algebraic and Transcendental equation**

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

### **Unit – 5: Curve Fitting**

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials.

### **Text Book**

Numerical Analysis by G. Shanker Rao, New Age International Publications

### **References:**

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7<sup>th</sup> Edition.
- 2.Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6<sup>th</sup> edition.

### **Co-Curricular Activities:**

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

**CO-PO Mapping:**

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	3	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	3	2	3	3	2	1	3	1	2

**BLUE PRINT FOR QUESTION PAPER PATTERN  
SEMESTER-III : PAPER-VI**

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	The calculus of finite differences	2	1	20
II	Interpolation with Equal and Unequal intervals	2	2	30
III	Central Difference Interpolation formulae	1	1	15
IV	Solution of Algebraic and Transcendental equation	1	1	15
V	Curve fitting	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20

Essay questions : 3X10 = 30

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Total Marks = 50

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**Pithapur Rajah's Government College (Autonomous), Kakinada**

**II year B.Sc., Degree Examinations - III Semester**

**Mathematics Course VI: NUMERICAL METHODS**

**Model Paper (w.e.f. 2024-25)**

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**Time: 2Hrs**

**Max. Marks: 50**

**SECTION-A**

**Answer Any Three Questions, Selecting At Least One Question from Each Part.**

**Part – A**

**3 X 10 = 30 M**

4. Essay question from unit - I.
5. Essay question from unit – II.
6. Essay question from unit – II.

**Part – B**

7. Essay question from unit - III.
8. Essay question from unit - IV.
9. Essay question from unit - V.


**SECTION-B**

**Answer any four questions**

**4 X 5 M = 20 M**

10. Short answer question from unit – I.
11. Short answer question from unit – I.
12. Short answer question from unit – II.
13. Short answer question from unit – II.
14. Short answer question from unit - III.
15. Short answer question from unit - IV.
16. Short answer question from unit – V.

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	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc Major (III Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT-302 P	<b>TITLE OF THE COURSE</b>  <b>Numerical Methods &amp; Problem Solving Sessions Practical Course</b>				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Advanced Calculus, Linear Algebra and Differential Equations	-	-	2	1

### Unit – 1:

#### The calculus of finite differences

The operators,  $\Delta$ ,  $\nabla$ ,  $E$  - Fundamental theorem of difference calculus- properties of,  $\Delta$ ,  $\nabla$ ,  $E$  and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between  $E$  and  $D$  - relation between  $D$  and  $\Delta$  - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation

#### Unit – 2: Interpolation with Equal and Unequal intervals

Derivations of Newton – Gregory Forward and backward interpolation and problems on them. Divided differences - Newton divided difference formula - Lagrange's and problems on them.

#### Unit – 3: Central Difference Interpolation formulae

Central Difference operators,  $\delta$ ,  $\mu$ ,  $\sigma$  and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirlings formula - Bessel's formula and problems on the above formulae

#### Unit – 4: Solution of Algebraic and Transcendental equation

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

#### Unit – 5: Curve Fitting

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials.

## Text Book

Numerical Analysis by G. Shanker Rao, New Age International Publications

## References:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7<sup>th</sup> Edition.
2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6<sup>th</sup> edition.

### Semester – III End Practical Examinations

#### Scheme of Valuation for Practical's

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

#### BLUE PRINT FOR PRACTICAL PAPER PATTERN

#### COURSE-VI - NUMERICAL METHODS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	The calculus of finite differences	2	06
II	Interpolation with Equal and Unequal intervals	2	12
III	Central Difference Interpolation formulae	1	12
IV	Solution of Algebraic and Transcendental equation	2	06
V	Curve Fitting	1	12
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II year B.Sc., Degree Examinations - III Semester**  
**Mathematics Course-VI: NUMERICAL METHODS**  
**(w.e.f. 2023-24 Admitted Batch)**  
**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**


**SECTION - A**

1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

- **Record - 10 Marks**
- **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program&amp;Semester</b>  II B.Sc. Major (III Sem) w.e.f 2023-24 admitted batch			
CourseCode  MAT- 303 T	<b>TITLEOFTHECOURSE</b>  <b>Laplace Transforms &amp; Problem Solving Sessions</b>				
Teaching	HoursAllocated:60( <b>Theory</b> )	L	T	P	C
Pre-requisites:	Knowledge of Calculus, specifically integration and differentiation and an understanding of Complex numbers.	3	1	-	3

### Course Objectives:

To formalise the study of numbers and functions and to investigate important concepts such as limits and continuity. These concepts underpin calculus and its applications.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Understand the definition and properties of Laplace transformations.
C02	Get an idea about first and second shifting theorems and change of scale property.
C03	Understand Laplace transforms of standard functions like Bessel, Error function etc
C04	Know the reverse transformation of Laplace and properties.
C05	Get the knowledge of application of convolution theorem.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### UNIT I

#### LAPLACE TRANSFORMS – I

Definition of Laplace Transform - Linearity Property - Piecewise Continuous Function - Existence of Laplace Transform - Functions of Exponential order and of Class A.

#### UNIT II:

#### LAPLACE TRANSFORMS – II

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace transform of the derivative of  $f(t)$ , Initial value theorem and Final value theorem.

### UNIT III:

#### LAPLACE TRANSFORM – III

Laplace Transform of Integrals - Multiplication by  $t$ , Multiplication by  $tn$  - division by  $t$  -Laplace transform of Bessel Function - Laplace Transform of Error Function – Laplace transform of Sine and Cosine integrals.

### UNIT IV:

#### INVERSE LAPLACE TRANSFORMS – I

Definition of Inverse Laplace Transform - Linearity Property - First Shifting Theorem -Second Shifting Theorem - Change of Scale property - use of partial fractions - Examples.

### UNIT V:

#### INVERSE LAPLACE TRANSFORMS – II

Inverse Laplace transforms of Derivatives - Inverse Laplace Transforms of Integrals -Multiplication by Powers of ' $p$ ' - Division by powers of ' $p$ ' - Convolution Definition -Convolution Theorem - proof and Applications - Heaviside's Expansion theorem and its Applications.

#### Co-Curricular Activities

Seminar/ Quiz/ Assignments/ Applications of Laplace Transforms to Real life Problem /Problem Solving Sessions.

#### TEXT BOOK

Laplace Transforms by A.R. Vasishtha, Dr.R.K.Gupta, KrishnaPrakashanMedia Pvt.Ltd., Meerut.

#### REFERENCE BOOKS:

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press
2. Laplace and Fouries transforms by Dr.J.K. Goyal and K.P. Guptha, PragathiPrakashan, Meerut.

#### CO-PO Mapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	3	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	1	3	3	1	1	3	1	2
C05	2	2	3	2	2	3	3	1	3	3	3	2	1

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SEMESTER-III

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	LAPLACE TRANSFORMS – I	1	1	15
II	LAPLACE TRANSFORMS – II	2	2	30
III	LAPLACE TRNASFORM – III	2	1	20
IV	INVERSE LAPLACE TRANSFORMS – I	1	1	15
V	INVERSE LAPLACE TRANSFORMS – II	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M

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**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**II year B.Sc., Degree Examinations - III Semester**  
**Mathematics Course VII: LAPLACE TRANSFORMS**  
**Model Paper (w.e.f. 2024-25)**

Time: 2Hrs

Max. Marks: 50

**SECTION-A**

Answer any three questions selecting atleast one question from each part

**Part – A**

**3 X 10 = 30**

1. Essay question from unit - I.
2. Essay question from unit - II.
3. Essay question from unit - II.

**Part – B**


4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

**SECTION-B**

Answer any four questions

**4 X 5 M = 20 M**

7. Short answer question from unit – I.
8. Short answer question from unit - II.
9. Short answer question from unit – II.
10. Short answer question from unit - III .
11. Short answer question from unit – III.
12. Short answer question from unit – IV.
13. Short answer question from unit - V

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major (III Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 303 P	<b>TITLE OF THE COURSE</b>  <b>Laplace Transforms &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites:	Knowledge of Calculus, specifically integration and differentiation and an understanding of Complex numbers.	-	-	2	1

### UNIT I

#### LAPLACE TRANSFORMS – I

Definition of Laplace Transform - Linearity Property - Piecewise Continuous Function - Existence of Laplace Transform - Functions of Exponential order and of Class A.

### UNIT II:

#### LAPLACE TRANSFORMS – II

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace transform of the derivative of  $f(t)$ , Initial value theorem and Final value theorem.

### UNIT III:

#### LAPLACE TRANSFORMS – III

Laplace Transform of Integrals - Multiplication by  $t$ , Multiplication by  $tn$  - division by  $t$  - Laplace transform of Bessel Function - Laplace Transform of Error Function – Laplace transform of Sine and Cosine integrals.

### UNIT IV:

#### INVERSE LAPLACE TRANSFORMS – I

Definition of Inverse Laplace Transform - Linearity Property - First Shifting Theorem - Second Shifting Theorem - Change of Scale property - use of partial fractions - Examples.

### UNIT V:

#### INVERSE LAPLACE TRANSFORMS – II

Inverse Laplace transforms of Derivatives - Inverse Laplace Transforms of Integrals - Multiplication by Powers of ' $p$ ' - Division by powers of ' $p$ ' - Convolution Definition - Convolution Theorem - proof and Applications - Heaviside's Expansion theorem and its Applications.

**TEXT BOOK:**

Laplace Transforms by A.R. Vasishtha, Dr. R.K. Gupta, Krishna Prakashan Media Pvt. Ltd., Meerut.

**REFERENCE BOOKS:**

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press
2. Laplace and Fourier's transforms by Dr. J.K. Goyal and K.P. Gupta, Pragathi Prakashan, Meerut.

**Semester – III End Practical Examinations****Scheme of Valuation for Practical's****Time : 2 Hours****Max. Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

**BLUE PRINT FOR PRACTICAL PAPER PATTERN****COURSE-VII - LAPLACE TRANSFORMS**

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	LAPLACE TRANSFORMS – I	2	06
II	LAPLACE TRANSFORMS – II	2	12
III	LAPLACE TRANSFORM – III	1	12
IV	INVERSE LAPLACE TRANSFORMS – I	2	06
V	INVERSE LAPLACE TRANSFORMS – II	1	12
	<b>Total</b>	08	48

**PITHAPUR GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**II year B.Sc., Degree Examinations - III Semester**

**Mathematics Course-VII: LAPLACE TRANSFORMS**

**(w.e.f. 2023-24 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**


**SECTION - A**

1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

- **Record - 10 Marks**
- **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major (III Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 304 T	<b>TITLE OF THE COURSE</b>  <b>SPECIAL FUNCTIONS &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Multivariable calculus and Differential Equations	3	1	-	3

### Course Objectives:

To formalise the study of numbers and functions and to investigate important concepts such as limits and continuity. These concepts underpin calculus and its applications.

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
CO2	Find power series solutions of ordinary differential equations
CO3	Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also
CO4	Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.
CO5	Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### UNIT I

#### Beta and Gamma functions, Chebyshev polynomials

Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.

Another form of Beta Function, Relation between Beta and Gamma Functions.

Chebyshev polynomials, orthogonal properties of Chebyshev polynomials, recurrence relations, generating functions for Chebyshev polynomials.

#### **UNIT II:**

##### **Power series and Power series solutions of ordinary differential equations.**

Introduction, summary of useful results, power series, radius of convergence, theorems on Power series Introduction of power series solutions of ordinary differential equation Ordinary and singular points, regular and irregular singular points, power series solution.

#### **UNIT III:**

##### **Hermite polynomials**

Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

#### **UNIT IV:**

##### **Legendre polynomials**

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree  $n$ , generating function of Legendre polynomials. ,
2. Definition of  $P_n(x)$  and  $Q_n(x)$ , General solution of Legendre's Equation (derivations not required )to show that  $P_n(x)$  is the coefficient of  $h^n$  , in the expansion of  $(1 - 2xh + h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

#### **UNIT V:**

##### **Bessel's equation**

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order  $n$ , Bessel's function of the second kind of order  $n$ .
2. Integration of Bessel's equation in series form=0, Definition of  $J_n(x)$ , recurrence formulae for  $J_n(x)$ .
3. Generating function for  $J_n(x)$ , orthogonality of Bessel functions.

#### **Co-Curricular Activities**

Seminar/ Quiz/ Assignments/ Applications of Functions of complex variables to Real life Problem /Problem Solving Sessions.

#### **TEXT BOOK**

Theory of Functions of a Complex variable by Shanti Narayan &Dr. P. K. Mittal, S. Chand &Company Ltd.

#### **REFERENCE BOOKS:**

1. Theory of Functions of a Complex Variable by A. I. Markushevich, Second Edition, AMS Chelsea Publishing
2. Theory And Applications by M. S. Kasara, Complex Variables, 2nd Edition, Prentice Hall India Learning Private Limited

**CO-PO Mapping:**

(1:Slight[Low];                      2:Moderate[Medium];                      3:Substantial[High],                      0:NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
C01	3	3	2	3	3	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	1	3	3	1	1	3	1	2
C05	2	2	3	2	2	3	3	1	3	3	3	2	1

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SEMESTER-III**

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Beta and Gamma functions, Chebyshev polynomials.	2	1	15
II	Power series and Power series solutions of ordinary differential equations.	1	2	30
III	Hermite polynomials	2	1	20
IV	Legendre polynomials	1	1	15
V	Bessel's equation	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

.....  
Total Marks = 50 M

**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**II year B.Sc., Degree Examinations - III Semester**  
**Mathematics Course VIII: SPECIAL FUNCTIONS**  
**Model Paper (w.e.f. 2024-25)**

Time: 2Hrs

Max. Marks: 50

**SECTION-A**

Answer any three questions selecting atleast one question from each part

**Part – A**

**3 X 10 = 30**

1. Essay question from unit - I.
2. Essay question from unit - I.
3. Essay question from unit - II.

**Part – B**


4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

**SECTION-B**

Answer any four questions

**4 X 5 M = 20 M**

7. Short answer question from unit – I.
8. Short answer question from unit - II.
9. Short answer question from unit – II.
10. Short answer question from unit - III .
11. Short answer question from unit – III.
12. Short answer question from unit – IV.
13. Short answer question from unit - V

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major (III Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 304 P	<b>TITLE OF THE COURSE</b>  <b>Special Functions &amp; Problem Solving Sessions Practical Course</b>				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites:	Multivariable calculus and Differential Equations	-	-	2	1

## UNIT I

### Beta and Gamma functions, Chebyshev polynomials

Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.

Another form of Beta Function, Relation between Beta and Gamma Functions.

Chebyshev polynomials, orthogonal properties of Chebyshev polynomials, recurrence relations, generating functions for Chebyshev polynomials.

### UNIT II:

#### Power series and Power series solutions of ordinary differential equations.

Introduction, summary of useful results, power series, radius of convergence, theorems on Power series Introduction of power series solutions of ordinary differential equation Ordinary and singular points, regular and irregular singular points, power series solution.

### UNIT III:

#### Hermite polynomials

Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

### UNIT IV:

#### Legendre polynomials

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree  $n$ , generating function of Legendre polynomials. ,
2. Definition of  $P_n(x)$  and  $Q_n(x)$ , General solution of Legendre's Equation (derivations not required )to show that  $P_n(x)$  is the coefficient of  $h^n$  , in the expansion of  $(1 - 2xh + h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

### UNIT V:

#### Bessel's equation

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order  $n$ , Bessel's function of the second kind of order  $n$ .

2. Integration of Bessel's equation in series form=0, Definition of  $J_n(x)$ , recurrence formulae for  $J_n(x)$ . 3. Generating function for  $J_n(x)$ , orthogonally of Bessel functions.

**TEXT BOOK:**

Theory of Functions of a Complex variable by Shanti Narayan & Dr. P. K. Mittal, S. Chand & Company Ltd.

**REFERENCE BOOKS:**

1. Theory of Functions of a Complex Variable by A. I. Markushevich, Second Edition, AMS Chelsea Publishing
2. Theory And Applications by M. S. Kasara, Complex Variables, 2nd Edition, Prentice Hall India Learning Private Limited

**Semester – III End Practical Examinations**

**Scheme of Valuation for Practical's**

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

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**COURSE-VIII - SPECIAL FUNCTIONS**

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Beta and Gamma functions, Chebyshev polynomials.	2	06
II	Power series and Power series solutions of ordinary differential equations.	2	12
III	Hermite polynomials	1	12
IV	Legendre polynomials	2	06
V	Bessel's equation	1	12
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**  
**II year B.Sc., Degree Examinations - III Semester**  
**Mathematics Course-VIII: SPECIAL FUNCTIONS**  
**(w.e.f. 2023-24 Admitted Batch)**  
**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**

**SECTION - A**


1. Unit - I.
2. Unit - I.
3. Unit - II.
4. Unit - II.

**SECTION - B**

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major & Minor (IV Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 401 T	<b>TITLE OF THE COURSE</b>  <b>Ring Theory &amp; Problem Solving</b>  <b>Sessions</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic set theory and Linear Algebra	3	1	-	3

### Course Objectives:

To formalise the study of numbers and functions and to investigate important concepts such as limits and continuity. These concepts underpin calculus and its applications.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Acquire the basic knowledge of rings, fields and integral domains.
C02	Get the knowledge of subrings and ideals.
C03	Construct composition tables for finite quotient rings.
C04	Study the homomorphisms and isomorphisms with applications.
C05	Get the idea of division algorithm of polynomials over a field.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### Unit – 1

#### Rings and Fields

Definition of a ring and Examples – Basic properties – Boolean rings - Fields – Divisors of 0 and Cancellation Laws – Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field.

#### Subrings and Ideals

Definition and examples of Subrings – Necessary and sufficient conditions for a subset to be a subring – Algebra of Subrings – Centre of a ring – left, right and two sided ideals – Algebra of ideals

### Unit III:

#### Principal ideals and Quotient rings

Definition of a Principal ideal ring(Domain) – Every field is a PID – The ring of integers is a PID – Example of a ring which is not a PIR – Cosets – Algebra of cosets – Quotient rings.

### Unit – 4

#### Homomorphism of Rings

Homomorphism of Rings – Definition and Elementary properties – Kernel of a homomorphism – Isomorphism – Fundamental theorems of homomorphism of rings – Maximal and prime Ideals – Prime Fields.

### Unit – 5

#### Rings of Polynomials

Polynomials in an indeterminate – The Evaluation morphism -- The Division Algorithm in  $F[x]$  – Irreducible Polynomials – Ideal Structure in  $F[x]$  – Uniqueness of Factorization  $F[x]$ .

### Activities

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

### Text book

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

### Reference books

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.
2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

### CO-PO Mapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	3	2	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	2	3	3	1	1	3	1	2
C05	2	3	2	3	2	3	2	2	2	3	2	2	3

BLUE PRINT FOR QUESTION PAPER PATTERN  
SEMESTER-IV

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Rings and Fields	1	1	15
II	Sub Rings and Ideals	2	1	20
III	Principal Ideals and Quotient Rings	1	1	15
IV	Homomorphisms of Rings	1	2	25
V	Rings of Polynomials	2	1	20
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

.....  
Total Marks = 50 M

**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**II year B.Sc., Degree Examinations - IV Semester**  
**Mathematics Course IX: Ring Theory**  
**Model Paper (w.e.f. 2024-25)**

Time: 2Hrs

Max. Marks: 50

**SECTION-A**

Answer any three questions selecting atleast one question from each part

**Part – A**

**3 X 10 = 30**

1. Essay question from unit - I.
2. Essay question from unit - II.
3. Essay question from unit - III.

**Part – B**


4. Essay question from unit - IV.
5. Essay question from unit - IV.
6. Essay question from unit - V.

**SECTION-B**

Answer any four questions

**4 X 5 M = 20 M**

7. Short answer question from unit – I.
8. Short answer question from unit - II.
9. Short answer question from unit – II.
10. Short answer question from unit - III .
11. Short answer question from unit – IV.
12. Short answer question from unit – V.
13. Short answer question from unit - V

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major & Minor (IV Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 401 P	<b>TITLE OF THE COURSE</b>  <b>Ring Theory &amp; Problem Solving</b>  <b>Sessions</b>				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites:	Basic set theory and Linear Algebra	-	-	2	1

### Unit – 1

#### Rings and Fields

Definition of a ring and Examples – Basic properties – Boolean rings - Fields – Divisors of 0 and Cancellation Laws – Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field.

### Unit – 2

#### Subrings and Ideals

Definition and examples of Subrings – Necessary and sufficient conditions for a subset to be a subring – Algebra of Subrings – Centre of a ring – left, right and two sided ideals – Algebra of ideals.

### Unit III:

#### Principal ideals and Quotient rings

Definition of a Principal ideal ring (Domain) – Every field is a PID – The ring of integers is a PID – Example of a ring which is not a PIR – Cosets – Algebra of cosets – Quotient rings.

### Unit – 4

#### Homomorphism of Rings

Homomorphism of Rings – Definition and Elementary properties – Kernel of a homomorphism – Isomorphism – Fundamental theorems of homomorphism of rings – Maximal and prime Ideals – Prime Fields.

### Unit – 5

#### Rings of Polynomials

Polynomials in an indeterminate – The Evaluation morphism -- The Division Algorithm in  $F[x]$  – Irreducible Polynomials – Ideal Structure in  $F[x]$  – Uniqueness of Factorization  $F[x]$ .

#### Text book

Modern Algebra by A.R. Vasishta and A.K. Vasishta, Krishna Prakashan Media Pvt. Ltd.

#### Reference books

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.
2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

## Semester – IV End Practical Examinations

### Scheme of Valuation for Practical's

Time : 2 Hours

Max.Marks : 50

- Record - 10 Marks
- Viva voce - 10 Marks
- Test - 30 Marks
- Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.

### BLUE PRINT FOR PRACTICAL PAPER PATTERN

#### COURSE-IX - RING THEORY

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Rings and Fields	2	12
II	Sub Rings and Ideals	2	12
III	Principal Ideals and Quotient Rings	1	06
IV	Homomorphisms of Rings	1	06
V	Rings of Polynomials	2	12
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**II year B.Sc., Degree Examinations - IV Semester**

**Mathematics Course-IX: RING THEORY**

**(w.e.f. 2023-24 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**


**SECTION - A**

1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - V.
8. Unit - V.

- **Record - 10 Marks**
- **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major & Minor (IV Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 402 T	<b>TITLE OF THE COURSE</b>  <b>Introduction to Real Analysis &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Knowledge of Multivariate Calculus and Linear Algebra	3	1	-	3

### Course Objectives:

To formalise the study of numbers and functions and to investigate important concepts such as limits and continuity. These concepts underpin calculus and its applications.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Get clear idea about the real numbers and real valued functions.
C02	Obtain the skills of analysing the concepts and applying appropriate methods for testing
C03	Test the continuity and differentiability and Riemann integration of a function.
C04	Know the geometrical interpretation of mean value theorems and the fundamental theorem of integral calculus

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### Unit – I

#### REAL NUMBERS, REAL SEQUENCES

The algebraic and order properties of  $\mathbb{R}$  - Absolute value and Real line - Completeness property of  $\mathbb{R}$  - Applications of supremum property - intervals. (No question is to be set from this portion) Sequences and their limits - Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence - The Cauchy's criterion - properly divergent sequences - Monotone sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence - Sub sequences and the Bolzano-Weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence.

## Unit – II

### INFINITE SERIES

Introduction to series -convergence of series -Cauchy's general principle of convergence for series tests or convergence of series - Series of non-negative terms - P- test - Cauchy's nth root test -D'-Alembert's Test.

## Unit – III

### LIMIT & CONTINUITY

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity (No question is to be set from this portion).Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

## Unit IV:

### DIFFERENTIATION AND MEAN VALUE THEOREMS

The derivability of a function at a point and on an interval - Derivability and continuity of a function -Mean value Theorems -Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem.

## Unit – V

### RIEMANN INTEGRATION

Riemann Integral - Riemann integral functions - Darboux theorem -Necessary and sufficient condition for R integrability - Properties of integrable functions - Fundamental theorem of integral calculus - Mean value Theorems.

### Activities

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

### Text book

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

### Reference books

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.
2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

### CO-PO Mapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High], '-' :NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	2	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	2	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	1	3	3	2	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN  
SEMESTER-IV

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	REAL NUMBERS, REAL SEQUENCES	1	1	15
II	INFINITIE SERIES	2	2	30
III	LIMITS & CONTINUITY	2	1	20
IV	DIFFERENTIATION AND MEAN VALUE THEORMS	1	1	15
V	RIEMANNINTEGRATION	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M  
.....

**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**II year B.Sc., Degree Examinations - IV Semester**  
**Mathematics Course X: Introduction to Real Analysis**  
**Model Paper (w.e.f. 2024-25)**

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**Time: 2Hrs**

**Max. Marks: 50**

**SECTION-A**

**Answer any three questions selecting atleast one question from each part**

**Part – A**

**3 X 10 = 30 M**

1. Essay question from unit - I.
2. Essay question from unit - II.
3. Essay question from unit - II.

**Part – B**


4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

**SECTION-B**

**Answer any four questions**

**4 X 5 M = 20 M**

7. Short answer question from unit – I.
8. Short answer question from unit - II.
9. Short answer question from unit – II.
10. Short answer question from unit - III .
11. Short answer question from unit – III.
12. Short answer question from unit – IV.
13. Short answer question from unit - V

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major & Minor (IV Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 402 P	<b>TITLE OF THE COURSE</b>  <b>Introduction to Real Analysis &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites:	Knowledge of Multivariate Calculus and Linear Algebra	-	-	2	1

### Unit – I

#### REAL NUMBERS, REAL SEQUENCES

The algebraic and order properties of  $\mathbb{R}$  - Absolute value and Real line - Completeness property of  $\mathbb{R}$  - Applications of supremum property - intervals. (No question is to be set from this portion) Sequences and their limits - Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence - The Cauchy's criterion - properly divergent sequences - Monotone sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence - Sub sequences and the Bolzano-Weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence.

### Unit – II

#### INFINITE SERIES

Introduction to series - convergence of series - Cauchy's general principle of convergence for series tests or convergence of series - Series of non-negative terms - P- test - Cauchy's nth root test - D'-Alembert's Test.

### Unit – III

#### LIMIT & CONTINUITY

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity (No question is to be set from this portion). Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

### Unit IV:

#### DIFFERENTIATION AND MEAN VALUE THEOREMS

The derivability of a function at a point and on an interval - Derivability and continuity of a function - Mean value Theorems - Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem.

### Unit – V

#### RIEMANN INTEGRATION

Riemann Integral - Riemann integral functions - Darboux theorem - Necessary and sufficient condition for  $\mathbb{R}$  integrability - Properties of integrable functions - Fundamental theorem of

integral calculus - Mean value Theorems.

### Activities

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

### Text book

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

### Reference books

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.
2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

## Semester – IV End Practical Examinations

### Scheme of Valuation for Practical's

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

### BLUE PRINT FOR PRACTICAL PAPER PATTERN COURSE-X: INTRODUCTION TO REAL ANALYSIS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	REAL NUMBERS, REAL SEQUENCES	2	12
II	INFINITIE SERIES	2	12
III	LIMITS & CONTINUITY	2	12
IV	DIFFERENTIATION AND MEAN VALUE THEORMS	1	06
V	RIEMANNINTEGRATION	1	06
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**II year B.Sc., Degree Examinations – IV Semester**

**Mathematics Course-X: Introduction to Real Analysis**

**(w.e.f. 2023-24 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**


**SECTION – A**

1. Unit – I.
2. Unit – I.
3. Unit – II.
4. Unit – II.

**SECTION – B**

5. Unit – III.
6. Unit – IV.
7. Unit – IV.
8. Unit – V.

- **Record - 10 Marks**
- **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major (IV Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 403 T	<b>TITLE OF THE COURSE</b>  <b>Integral Transforms with Applications &amp; Problem  Solving Sessions</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites:	Ordinary differential Equations and complex variables	3	1	-	3

### Course Objectives:

To formalise the study of numbers and functions and to investigate important concepts such as limits and continuity. These concepts underpin calculus and its applications.

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand the application of Laplace transforms to solve ODEs.
CO2	Understand the application of Laplace transforms to solve Simultaneous Des and the application of Laplace transforms to Integral equations
CO3	Basic knowledge of Fourier-Transformations
CO4	Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### Unit – I

#### Application of Laplace Transform to solutions of Differential Equations

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constants coefficients - Solutions of Differential Equations with Variable coefficients.

### Unit – II

#### Application of Laplace Transform to solutions of Differential Equations

Solutions of Simultaneous Ordinary Differential equations - Solutions of Partial Differential Equations.

**Unit – III**

**Application of Laplace Transforms to Integral Equations**

Definitions of Integral Equations - Abel's Integral Equation - Integral Equation of Convolution Type -Integral Differential Equations - Application of L.T. to Integral Equations.

**Unit IV:**

**Fourier Transforms - I**

Definition of Fourier Transform - Fourier sine Transform - Fourier cosine Transform - Linear Property of Fourier Transform - Change of Scale Property for Fourier Transform - sine Transform and cosine transform shifting property - Modulation theorem.

**Unit – V**

**Fourier Transforms – II**

Definition of Convolution - Convolution theorem for Fourier transform - Parseval's Identity - Relationship between Fourier and Laplace transforms - problems related to Integral Equations - Finite Fourier Transforms - Finite Fourier Sine Transform - Finite Fourier Cosine Transform – Inversion formula for sine and cosine transforms only - statement and related problems

**Activities**

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

**Text book**

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017

**Reference books**

1. Fourier Series and Integral Transformations by Dr.S. Sreenadh and others, published by S.Chand and Co, New Delhi
2. E.M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton University Press,2003).
3. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003)

**CO-PO Mapping:**

(1:Slight[Low];                    2:Moderate[Medium];                    3:Substantial[High],                    '-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01	3	3	2	3	3	3	1	2	2	3	2	3	2
C02	3	2	3	3	2	3	3	1	3	3	3	2	1
C03	2	3	2	3	2	3	2	2	2	3	2	2	3
C04	3	2	3	2	2	1	3	3	1	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN  
SEMESTER-IV

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Application of Laplace Transform to solutions of Differential Equations	2	1	20
II	Application of Laplace Transform to solutions of Differential Equations	2	2	30
III	Application of Laplace Transforms to Integral Equations	1	1	15
IV	Fourier Transforms - I	1	1	15
V	Fourier Transforms - II	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

.....  
Total Marks = 50 M  
.....

**Pithapur Rajah's Government College (Autonomous), Kakinada**  
**II year B.Sc., Degree Examinations - IV Semester**  
**Mathematics Course XI: Integral Transform with Applications**  
**Model Paper (w.e.f. 2024-25)**

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**Time: 2Hrs**

**Max. Marks: 50**

**SECTION-A**

**Answer any three questions selecting at least one question from each part**

**Part – A**

**3 X 10 = 30**

1. Essay question from unit - I.
2. Essay question from unit - II.
3. Essay question from unit - II.

**Part – B**


4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

**SECTION-B**

**Answer any four questions**

**4 X 5 M = 20 M**

7. Short answer question from unit – I.
8. Short answer question from unit - I.
9. Short answer question from unit – II.
10. Short answer question from unit - II .
11. Short answer question from unit – III.
12. Short answer question from unit – IV.
13. Short answer question from unit - V

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  II B.Sc. Major (IV Sem) w.e.f 2023-24 admitted batch			
Course Code  MAT- 403 P	<b>TITLE OF THE COURSE</b>  <b>Integral Transforms with Applications &amp; Problem Solving Sessions</b>				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Ordinary differential Equations and complex variables	-	-	2	1

### Unit – I

#### Application of Laplace Transform to solutions of Differential Equations

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constants coefficients - Solutions of Differential Equations with Variable coefficients.

### Unit – II

#### Application of Laplace Transform to solutions of Differential Equations

Solutions of Simultaneous Ordinary Differential equations - Solutions of Partial Differential Equations.

### Unit – III

#### Application of Laplace Transforms to Integral Equations

Definitions of Integral Equations - Abel's Integral Equation - Integral Equation of Convolution Type - Integral Differential Equations - Application of L.T. to Integral Equations.

### Unit IV:

#### Fourier Transforms - I

Definition of Fourier Transform - Fourier sine Transform - Fourier cosine Transform - Linear Property of Fourier Transform - Change of Scale Property for Fourier Transform - sine Transform and cosine transform shifting property - Modulation theorem.

### Unit – V

#### Fourier Transforms – II

Definition of Convolution - Convolution theorem for Fourier transform - Parseval's Identity - Relationship between Fourier and Laplace transforms - problems related to Integral Equations - Finite Fourier Transforms - Finite Fourier Sine Transform - Finite Fourier Cosine Transform – Inversion formula for sine and cosine transforms only - statement and related problems.

#### Text book

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017

#### Reference books

1. Fourier Series and Integral Transformations by Dr.S. Sreenadh and others, published by S.Chand and Co, New Delhi
2. E.M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton University Press,2003).
3. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003)

### Semester – IV End Practical Examinations

#### Scheme of Valuation for Practical's

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

#### BLUE PRINT FOR PRACTICAL PAPER PATTERN

#### COURSE-XI: INTEGRAL TRANSFORMS WITH APPLICATIONS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Application of Laplace Transform to solutions of Differential Equations	2	06
II	Application of Laplace Transform to solutions of Differential Equations	2	12
III	Application of Laplace Transforms to Integral Equations	1	12
IV	Fourier Transforms - I	2	06
V	Fourier Transforms - II	1	12
	<b>Total</b>	<b>08</b>	<b>48</b>

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**II year B.Sc., Degree Examinations - IV Semester**

**Mathematics Course-XI: Integral Transform with Applications**

**(w.e.f. 2023-24 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

.....

**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**

**SECTION - A**


1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b> III B.Sc. (V Sem)			
Course Code MAT-601A / 5231	<b>TITLE OF THE COURSE</b> <b>VI A- Numerical Methods</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Advanced Calculus, Linear Algebra and Differential Equations	4	1	-	4

### Course Objectives:

This course will cover the classical fundamental topics in numerical methods such as, approximation, numerical integration, numerical linear algebra, solution of nonlinear algebraic systems and solution of ordinary differential equations.

### Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand various finite difference concepts and interpolation methods.
CO2	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO3	Find numerical solutions of ordinary differential equations by using various numerical methods.
CO4	Analyze and evaluate the accuracy of numerical methods.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### Unit – 1: Finite Differences and Interpolation with Equal intervals

1. Introduction, Forward differences, Backward differences, Central Differences, Symbolic relations,  $n$ th Differences of Some functions,
2. Advancing Difference formula, Differences of a Polynomial.
3. Newton's formulae for interpolation.

## **Unit – 2: Interpolation with Equal and Unequal intervals**

### **1. Central Difference Interpolation Formulae.**

Gauss's Forward interpolation formulae, Gauss's backward interpolation formulae, Stirling's formula, Bessel's formula.

2. Interpolation with unevenly spaced points, divided differences and properties, Newton's divided differences formula.

3. Lagrange's interpolation formula, Lagrange's Inverse interpolation formula.

## **Unit – 3: Numerical Differentiation**

1. Derivatives using Newton's forward difference formula, Newton's backward difference formula,

2. Derivatives using central difference formula, Stirling's interpolation formula,

3. Newton's divided difference formula, Maximum and minimum values of a tabulated function.

## **Unit – 4: Numerical Integration**

1. General quadrature formula one errors, Trapezoidal rule,

2. Simpson's 1/3- rule, Simpson's 3/8 – rule and Weddle's rules,

3. Euler – McLaurin Formula of summation and quadrature, The Euler transformation.

## **Unit – 5: Numerical solution of ordinary differential equations**

1. Introduction, Solution by Taylor's Series,

2. Picard's method of successive approximations,

3. Euler's method, Modified Euler's method, Runge – Kutta methods.

## **III. References:**

1. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi-110001, 2006.

2. P.Kandasamy, K.Thilagavathy, Calculus of Finite Differences and Numerical Analysis. S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.

3. R.Gupta, Numerical Analysis, Laxmi Publications (P) Ltd., New Delhi.

4. H.C Saxena, Finite Differences and Numerical Analysis, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.

5. S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr.V.Ramesh Babu, Numerical Analysis, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.

6. Web resources suggested by the teacher and college librarian including reading material.

## **IV. Co-Curricular Activities: A) Mandatory:**

**1. For Teacher:** Teacher shall train students in the following skills for 15 hours, by taking relevant outside data (Field/Web).

1. Applications of Newton's forward and back ward difference formulae.
2. Applications of Gauss forward and Gauss back ward, Stirling's and Bessel's formulae.
3. Applications of Newton's divided differences formula and Lagrange's interpolation formula.
4. Various methods to find the approximation of a definite integral.
5. Different methods to find solutions of Ordinary Differential Equations.

**2. For Student:** Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work done in the areas like the following, by choosing any one of the aspects.

1. Collecting the data from the identified sources like Census department or Electricity department, by applying the Newton's, Gauss and Lagrange's interpolation formula, making observations and drawing conclusions. (Or)

2. Selection of some region to find the area by applying Trapezoidal rule, Simpson's 1/3- rule, Simpson's 3/8 - rule, and Weddle's rules. Comparing the solutions with analytical solution and concluding which one is the best method. (Or)

3. Findingsolutionof the ODE by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge-Kutta methods. Comparing the solutions with analytical solution, selecting the best method.

**3. Max. Marks for Fieldwork/Project work Report: 05.**

**4. Suggested Format for Fieldwork/Project work Report:** Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

**5. Unit tests (IE).**

**b) Suggested Co-Curricular Activities:**

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.
3. Invited lectures and presentations on related topics by experts in the specified area .

**CO-PO Mapping:**

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3
CO4	3	2	3	2	3	2	3	3	2	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN  
SEMESTER-V : PAPER-VI A

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Finite Differences and Interpolation with Equal intervals	2	1	20
II	Interpolation with Equal and Unequal intervals	2	2	30
III	Numerical Differentiation	1	1	15
IV	Numerical Integration	1	1	15
V	Numerical solution of ordinary differential equations	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20

Essay questions : 3X10 = 30

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Total Marks = 50

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**Pithapur Rajah's Government College (Autonomous), Kakinada**

**III Year B.Sc., Degree Examinations - V Semester**

**Mathematics Course VI A: NUMERICAL METHODS**

**Paper VI A (Model Paper w.e.f. 2023-24)**

**Time: 2Hrs**

**Max. Marks: 50**

**SECTION-A**

**Answer Any Three Questions, Selecting At Least One Question from Each Part.**

**Part – A**

**3 X 10 = 30**

1. Essay question from Unit - I.
2. Essay question from Unit – II
3. Essay question from Unit - II.

**Part – B**

4. Essay question from Unit - III .
5. Essay question from Unit - IV.
6. Essay question from Unit - V .


**SECTION-B**

**Answer any four questions**

**4 X 5 M = 20 M**

7. Short answer question from Unit - I.
8. Short answer question from Unit - I .
9. Short answer question from Unit – II.
10. Short answer question from Unit - II.
11. Short answer question from Unit - III.
12. Short answer question from unit – IV.
13. Short answer question from Unit – V.

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	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b> III B.Sc. (V Sem)			
Course Code MAT-601A / 5231	<b>TITLE OF THE COURSE</b> <b>VI A- Numerical Methods</b>				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:		-	-	2	1

### Unit – 1: Finite Differences and Interpolation with Equal intervals

1. Introduction, Forward differences, Backward differences, Central Differences, Symbolic relations, nth Differences of Some functions,
2. Advancing Difference formula, Differences of a Polynomial.
3. Newton's formulae for interpolation. Central Difference Interpolation Formulae.

### Unit – 2: Interpolation with Equal and Unequal intervals

1. Gauss's Forward interpolation formulae, Gauss's backward interpolation formulae, Stirling's formula, Bessel's formula.
2. Interpolation with unevenly spaced points, divided differences and properties, Newton's divided differences formula.
3. Lagrange's interpolation formula, Lagrange's Inverse interpolation formula.

### Unit – 3: Numerical Differentiation

1. Derivatives using Newton's forward difference formula, Newton's backward difference formula,
2. Derivatives using central difference formula, Stirling's interpolation formula,
3. Newton's divided difference formula, Maximum and minimum values of a tabulated function.

### Unit – 4: Numerical Integration

1. General quadrature formula one errors, Trapezoidal rule,
2. Simpson's 1/3- rule, Simpson's 3/8 - rule and Weddle's rules,
3. Euler – McLaurin Formula of summation and quadrature, The Euler transformation.

### Unit – 5: Numerical solution of ordinary differential equations

1. Introduction, Solution by Taylor's Series,
2. Picard's method of successive approximations,
3. Euler's method, Modified Euler's method, Runge – Kutta methods.

### III. References:

1. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi-110001, 2006.
2. P.Kandasamy, K.Thilagavathy, Calculus of Finite Differences and Numerical Analysis. S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.
3. R.Gupta, Numerical Analysis, Laxmi Publications (P) Ltd., New Delhi.
4. H.C Saxena, Finite Differences and Numerical Analysis, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
5. S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr.V.Ramesh Babu, Numerical Analysis, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
6. Web resources suggested by the teacher and college librarian including reading material.

### Semester – V End Practical Examinations

#### Scheme of Valuation for Practical's

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

### BLUE PRINT FOR PRACTICAL PAPER PATTERN

#### COURSE-VI A: NUMERICAL ANALYSIS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Finite Differences and Interpolation with Equal intervals	2	06
II	Interpolation with Equal and Unequal intervals	2	12
III	Numerical Differentiation	1	12
IV	Numerical Integration	2	06
V	Numerical solution of ordinary differential equations	1	12
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**III year B.Sc., Degree Examinations - V Semester**

**Mathematics Course-VI A: NUMERICAL ANALYSIS**

**(w.e.f. 2023-24 Admitted Batch)**

**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**

**SECTION - A**


1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b>  III B.Sc. (V Sem)			
Course Code <b>MAT-701A / 5281</b>	<b>TITLE OF THE COURSE</b>  <b>VII A - Mathematical Special Functions</b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Integration	4	1	-	4

### Course Objectives:

This course will cover the particular mathematical functions that have more or less established names and notations due to their importance in mathematical analysis, functional analysis, geometry, physics, or other applications.

### Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
C02	Find power series solutions of ordinary differential equations.
C03	Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.
C04	Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel function.

### Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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## II. Syllabus: (Hours: Teaching: 75 (incl. unit tests etc. 05), Training: 15)

### Unit – 1: Beta and Gamma functions.

1. Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.
2. Another form of Beta Function, Relation between Beta and Gamma Functions.

### Unit– 2: Power series and Power series solutions of ordinary differential equations

1. Introduction, summary of useful results, power series, radius of convergence, theorems on Power series
2. Introduction of power series solutions of ordinary differential equation
3. Ordinary and singular points, regular and irregular singular points, power series solution about the ordinary point  $x = x_0$ .

### Unit – 3: Hermite polynomials

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials.
2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.
3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

### Unit – 4: Legendre polynomials

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree  $n$ , generating function of Legendre polynomials. ,
2. Definition of  $P_n(x)$  and  $Q_n(x)$ , General solution of Legendre's Equation (derivations not required )to show that  $P_n(x)$  is the coefficient of  $h^n$  , in the expansion of  $(1 - 2xh + h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

### Unit – 5: Bessel's equation

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order  $n$ , Bessel's function of the second kind of order  $n$ .
2. Integration of Bessel's equation in series form=0, Definition of  $J_n(x)$ , recurrence formulae for  $J_n(x)$ .
3. Generating function for  $J_n(x)$ , orthogonality of Bessel functions.

### Additional Inputs :

Chebyshev Polynomials.

## II. Reference Books:

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. J.N.Sharma and Dr.R.K.Gupta, Differential equations with special functions, Krishna Prakashan Mandir.
3. Shanti Narayan and Dr.P.K.Mittal, Integral Calculus, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
4. George F.Simmons, Differential Equations with Applications and Historical Notes, Tata McGRAW-Hill Edition, 1994.
5. Shepley L.Ross, Differential equations, Second Edition, John Willy & sons, New York, 1974.
6. Web resources suggested by the teacher and college librarian including reading material.

## IV. Co-Curricular Activities:

**A) Mandatory: 1. For Teacher:** Teacher shall train students in the following skills for 15 hours, by taking relevant outside data (Field/Web).

1. Beta and Gamma functions.
2. Power series, power series solutions of ordinary differential equations,

3. Procedures of finding series solutions of Hermite equation, Legendre equation and Bessel equation.

4. Procedures of finding generating functions for Hermite polynomials, Legendre Polynomials and Bessel's function.

**2. For Student:** Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work, make observations and conclusions and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the aspects.

1. Going through the web sources like Open Educational Resources on the properties of Beta and Gamma functions, Chebyshev polynomials, power series solutions of ordinary differential equations.

(or)

2. Going through the web sources like Open Educational Resources on the properties of series solutions of Hermite equation, Legendre equation and Bessel equation.

**3. Max. Marks for Fieldwork/Project work Report: 05.**

**4. Suggested Format for Fieldwork/Project work Report:** Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

**5. Unit tests (IE).**

**b) Suggested Co-Curricular Activities:**

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates

2. Visits to research organizations, Statistical Cells, Universities, ISI etc.

3. Invited lectures and presentations on related topics by experts in the specified area.

**CO-PO Mapping:**

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3
CO4	3	2	3	2	2	1	3	3	1	1	3	1	2



**Pithapur Rajah's Government College (Autonomous), Kakinada**

**III Year B.Sc., Degree Examinations - V Semester**

**Mathematics Course VII A : SPECIAL FUNCTIONS**

**Paper -VIIA (Model Paper w.e.f. 2023-24)**

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**Time: 2Hrs**

**Max. Marks: 50**

**SECTION-A**

**Answer Any Three Questions, Selecting At Least One Question From Each Part**

**Part – A**

**3 X 10 = 30**

1. Essay question from Unit - I.
2. Essay question from Unit – I
3. Essay question from Unit - II.

**Part – B**

4. Essay question from Unit - III .
5. Essay question from Unit - IV.
6. Essay question from Unit - V .


**SECTION-B**

**Answer any four questions**

**4 X 5 M = 20 M**

7. Short answer question from Unit - I.
8. Short answer question from Unit - I .
9. Short answer question from Unit – II.
10. Short answer question from Unit - II.
11. Short answer question from Unit - III.
12. Short answer question from unit – IV.
13. Short answer question from Unit – V.

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	<b>P.R. Government College (Autonomous) KAKINADA</b>	<b>Program &amp; Semester</b> III B.Sc. (V Sem)			
Course Code <b>MAT-701A / 5281</b>	<b>TITLE OF THE COURSE</b> <b>VII A - Mathematical Special Functions</b>				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Integration	-	-	2	1

## II. Syllabus: (Hours: Teaching: 75 (incl. unit tests etc. 05), Training: 15)

### Unit – 1: Beta and Gamma functions.

1. Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions.
2. Another form of Beta Function, Relation between Beta and Gamma Functions.

### Unit– 2: Power series and Power series solutions of ordinary differential equations

1. Introduction, summary of useful results, power series, radius of convergence, theorems on Power series
2. Introduction of power series solutions of ordinary differential equation
3. Ordinary and singular points, regular and irregular singular points, power series solution about the ordinary point  $x = x_0$ .

### Unit – 3: Hermite polynomials

1. Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials.
2. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials.
3. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

### Unit – 4: Legendre polynomials

1. Definition, Solution of Legendre's equation, Legendre polynomial of degree  $n$ , generating function of Legendre polynomials. ,
2. Definition of  $P_n(x)$  and  $Q_n(x)$ , General solution of Legendre's Equation (derivations not required) to show that  $P_n(x)$  is the coefficient of  $h^n$  , in the expansion of  $(1 - 2xh + h^2)^{-1/2}$
3. Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

### Unit – 5: Bessel's equation

1. Definition, Solution of Bessel's equation, Bessel's function of the first kind of order  $n$ , Bessel's function of the second kind of order  $n$ .
2. Integration of Bessel's equation in series form  $m=0$ , Definition of  $J_n(x)$ , recurrence formulae for  $J_n(x)$ .
3. Generating function for  $J_n(x)$ , orthogonality of Bessel functions.

## II. Reference Books:

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. J.N.Sharma and Dr.R.K.Gupta, Differential equations with special functions, Krishna Prakashan Mandir.
3. Shanti Narayan and Dr.P.K.Mittal, Integral Calculus, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
4. George F.Simmons, Differential Equations with Applications and Historical Notes, Tata McGRAW-Hill Edition, 1994.
5. Shepley L.Ross, Differential equations, Second Edition, John Willy & sons, New York, 1974.
6. Web resources suggested by the teacher and college librarian including reading material.

### Semester – V End Practical Examinations

#### Scheme of Valuation for Practical's

**Time : 2 Hours**

**Max.Marks : 50**

- **Record - 10 Marks**
- **Viva voce - 10 Marks**
- **Test - 30 Marks**
- **Answer any 5 questions. At least 2 questions from each section. Each question carries 6 marks.**

#### BLUE PRINT FOR PRACTICAL PAPER PATTERN

#### COURSE-VII A: MATHEMATICAL SPECIAL FUNCTIONS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Beta and Gamma functions,	2	06
II	Power series and Power series solutions of ordinary differential equations	2	12
III	Hermite polynomials	1	12
IV	Legendre polynomials	2	06
V	Bessel's equation	1	12
	<b>Total</b>	08	48

**PITHAPUR RAJAH'S GOVT. COLLEGE (AUTONOMOUS), KAKINADA**  
**III year B.Sc., Degree Examinations - V Semester**  
**Mathematics Course-VII A: Mathematical Special functions**  
**(w.e.f. 2023-24 Admitted Batch)**  
**Practical Model Paper (w.e.f. 2024-2025)**

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**Time: 2Hrs**

**Max. Marks: 50M**

**Answer any 5 questions. At least 2 questions from each section.**

**5 x 6 = 30 Marks**

**SECTION - A**

1. Unit - I.
2. Unit – I.
3. Unit - II.
4. Unit – II.

**SECTION – B**

5. Unit - III.
6. Unit - IV.
7. Unit - IV.
8. Unit - V.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**Massive Open Online Course (MOOCS) CERTIFICATE COURSE**

**Additional Credits: Achieved Credits**

**Guidelines of this course:**

After completion of the course the student is able to get 2 additional credits through the examination cell under the following conditions.

- Completed the course through the online platforms Swayam, UGC, CEC, NPTEL, AICTE, NCERT, etc.
- Course related to any Mathematical subject or interdisciplinary with mathematics one of the subject.
- Course contains at least a minimum of 4 weeks.
- Course completion certificate must be submitted to the Examination cell through the department.

**For more details about online courses go through the following links:**

- <http://www.apcce.gov.in/SwC>
- <https://swayam.gov.in/>
- <http://free.aicte-india.org/>
- <https://ugcmoocs.inflibnet.ac.in/>
- [https://swayam.gov.in/nc\\_details/CEC](https://swayam.gov.in/nc_details/CEC)
- [https://swayam.gov.in/nc\\_details/NCERT](https://swayam.gov.in/nc_details/NCERT)

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**CERTIFICATE COURSE**

Paper – COMPETITIVE MATHEMATICS FOR NON-MATHS STUDENTS

**Total Hours – 30 hours /Additional Credits: 2**

**Unit – I: Analytical Ability**

**Date, Time Problems:** Calendar problems, clock problems, blood relationships.

**Arithmetical Ability**

Numbers and divisibility, Ratio and proportion, L.C.M and G.C.D Percentages, Profit and loss, Time, distance and work problems

**Unit – II : Algebra and Geometrical Ability**

Matrices, Linear equations and expressions, Binomial Theorem, Polynomials, Coordinate geometry-distance between points, Trigonometric ratios of standard angles ( $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $180^\circ$ ), Trigonometric identities: sample problems on heights and distances.

**Unit – III : Statistical Ability**

Mean, Median, Mode, Standard Deviation, Correlation

**BLUE PRINT FOR CERTIFICATE COURSE**

**Paper – COMPETATIVE MATHEMATICS FOR NON-MATHS STUDENTS**

<b>Unit</b>	<b>TOPIC</b>	<b>M.C.Q</b>	<b>Marks allotted to the Unit</b>
I	Analytical Ability & Arithmetical Ability	20	20
II	Algebra and Geometrical Ability	20	20
III	Statistical Ability	10	10
<b>Total</b>		<b>50</b>	<b>50</b>

**Question Paper pattern**

**M.C.Q.** = Multiple choice questions (1 marks)

Multiple choice questions : 50 x 1 = 50M

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Total Marks = 50M

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**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**WORK LOAD FOR THE YEAR 2024-2025 (ODD SEMESTERS)**

Name of the Subject : Mathematics

Total No. of Hours : 240

No. of Permanent posts sanctioned : 05

No. of Permanent staff working : Nil

No. of Contract faculty : 05

No. of Part – Time Faculty : 05

S. No	Name of the class	No. of Theory hours	No. of Practical Hours	No. of Batches	Total Practical Hours	Study Hour	Total hrs.(Theory + Practical+ Study Hour)
1	Course - I	10	-	-	-	-	10
2	Course - II	10	-	-	-	-	10
3	Analytical Skills	34	-	-	-	-	34
4	Major Course - V	3	2	4	8	1	12
5	Major Course – VI	3	2	4	8	1	12
6	Major Course – VII	3	2	4	8	1	12
7	Major Course - VIII	3	2	4	8	1	12
8	Minor Course – II (Stat)	3	2	2	4	1	8
	Minor Course – II (Che)	3	2	2	4	1	8
9	III MPC EM1	4+4	2+2	4	8+8	2	26
10	III MPC EM2, MPE	4+4	2+2	4	8+8	2	26
11	III MPCs,MECs	4+4	2+2	4	8+8	2	26
12	III MCCs, MSCs	4+4	2+2	4	8+8	2	26
13	III MCPC, MEIOT	4+4	2+2	2	4+4	2	18
<b>Total Work load for the subject Mathematics</b>							<b>240</b>

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA**

**DEPARTMENT OF MATHEMATICS**

**WORK LOAD FOR THE YEAR 2024-20245(EVEN SEMESTERS)**

Name of the Subject : Mathematics

Total No. of Hours : 108

No. of Permanent posts sanctioned : 05

No. of Permanent staff working : Nil

No. of Contract faculty : 05

No. of Part – Time Faculty : 02

S. No	Name of the class	No. of Theory hours	No. of Practical Hours	No.of Batches	Total Practical Hours	Study Hour	Total hrs.(Theory + Practical+ Study Hour)
1	Major Course – III	3	2	4	8	1	12
	Minor Course – I (Stat)	3	2	2	4	1	8
	Minor Course – I (Che)	3	2	2	4	1	8
2	Major Course - IV	3	2	4	8	1	12
3	Major Course - IX	3	2	4	8	1	12
4	Major Course – X	3	2	4	8	1	12
5	Major Course – XI	3	2	4	8	1	12
6	Minor Course – III (Stat)	3	2	2	4	1	8
7	Minor Course – III (Che)	3	2	2	4	1	8
8	Minor Course – IV (Stat)	3	2	2	4	1	8
9	Minor Course – IV (Che)	3	2	2	4	1	8
<b>Total Work load for the subject Mathematics</b>							

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**Department of Mathematics**

**Budget Proposal for the Academic Year 2024-25**

<b>S.No.</b>	<b>PURPOSE</b>	<b>EXPENDITURE ESTIMATED</b>	<b>REMARKS</b>
1.	Guest Faculty	$14400 \times 5 = 10 \text{ M}$ $= 576000$	
2.	National /International Seminars/Workshops/Conference	50000	
3.	Guest Lecture	15000	
4.	Field Trip / Industrial Tour	5000	
5.	AMC for all Labs	40000	
6.	Certificate / Add on Course	40000	
7.	Seed money	10000	
8.	Furniture (Wooden / Steel)	10000	
9.	Stationary	20000	
10	Computer & peripherals	15000	
<b>TOTAL Rs: 9,15,000</b>			

Budget estimated in Rupees : Nine Lakhs Fifteen thousand Rupees only.

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(Affiliated to ADI KAVI NANNAYA UNIVERSITY, Rajamahendravaram.)

### ACADEMIC CELL

(Certificate to be issued by the University Nomine/Subject Expert/Member of BOS)

Department Name : MATHEMATICS

Name of the BOS Member : Dr. V. Anantha Lakshmi Principal A.S.D. Govt. Degree  
College for Women (A) Kakinada  
(University Nomine/Subject Expert/Industrillist/ Member)  
University Nominee

I certify that the syllabus submitted by the Mathematics Department is verified by me and I recommend the following suggestions:

1. It is suggested to give options to students for doing <sup>one</sup> only project in a semester.
- 2.
- 3.
- 4.
- 5.

The syllabus is approved with the above suggested modification

V. Anantha Lakshmi  
Signature with Date 20/4/24

Note: BOS Members are requested to fill the above details with necessary suggestions and send back to the Head of the department along with the syllabus

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(Certificate to be issued by the University Nomine/Subject Expert/Member of BOS)

Department Name : MATHEMATICS

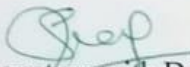
Name of the BOS Member : Dr. P. Subhashini, Principal, GDC, Pithapuram.

(University Nomine/Subject Expert/Industrialist/ Member)

I certify that the syllabus submitted by the Mathematics Department is verified by me and I recommend the following suggestions:

1. In the student point of view the BOS members felt that it is bit burden to complete the project work for each
2. paper in each semester. so that the BOS members suggested that to assign for one paper only and in the remaining papers suggested to conduct Quiz for 10 marks in CIA.
- 3.
4. From the feedback of the students, suggested that the practical examinations may be conducted before the commencement of the theory examinations.
- 5.

The syllabus is approved with the above suggested modification

  
Signature with Date

Note: BOS Members are requested to fill the above details with necessary suggestions and send back to the Head of the department along with the syllabus

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### ACADEMIC CELL

(Certificate to be issued by the University Nomine/Subject Expert/Member of BOS)

Department Name : MATHEMATICS

Name of the BOS Member : Sri KANDIKATLA CHITTAIAU  
Lecturer in Mathematics, GPC, Mommidiwaram  
(University Nomine/Subject Expert/Industrialist/ Member)

I certify that the syllabus submitted by the Mathematics Department is verified by me and I recommend the following suggestions:

1. In the student point of view the BOS members felt that it is bit burden to complete the
2. project work for each part in each semester
3. So that the BOS members suggested test ~~to be~~ the one project may be assessed for one part and in the remaining parts suggested to conduct online part for
4. 10 marks in CIA.
5. For the feedback of the students during the BOS meeting the BOS members suggested that the practical examinations may be conducted before the commencement of the theory examinations.
6. It is suggested by BOS to encourage the students to pursue the online courses of their choice before the hold of the members.

The syllabus is approved with the above suggested modification

K. Chittai  
Signature with Date 30/04/24

Note: BOS Members are requested to fill the above details with necessary suggestions and send back to the Head of the department along with the syllabus

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA  
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Department Name : MATHEMATICS

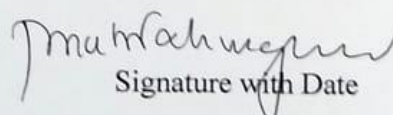
Name of the BOS Member : P.S.R SUBRAMANYAM

(University Nomine/Subject Expert/Industrialist/ Member)

I certify that the syllabus submitted by the Mathematics Department is verified by me and I recommend the following suggestions:

1. In the student point of view the BOS members felt that it is a bit burden to
2. Complete the project for each paper in each semester. so it is suggested to
3. assign one paper (project) in each semester.  
In the place of project, a quiz may be
4. conducted for 10 marks.
5. (2) Reg conduct of practical exams -  
(3) encourage online courses.

The syllabus is approved with the above suggested modification

  
Signature with Date

Note: BOS Members are requested to fill the above details with necessary suggestions and send back to the Head of the department along with the syllabus

Thank  
you

