

PITHAPUR RAJAH'S GOVERNMENT COLLEGE

(AUTONOMOUS)

KAKINADA

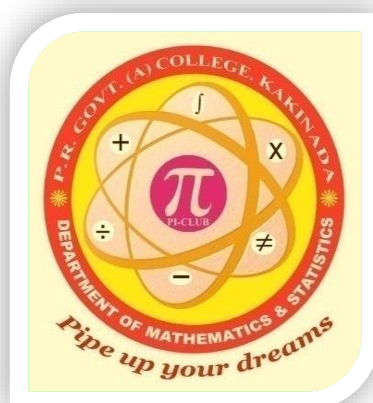
(Accredited by NAAC "A" Grade with 3.17 CGPA)

UG BOARD OF STUDIES : 2023 - 24



DEPARTMENT OF MATHEMATICS

Curriculum for the Academic Year 2023 - 24



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

Vision & Mission

i) Vision :

- ❖ The Mathematics Department offers a broad and challenging academic program that supports the mission of P.R.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 develop 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 foster 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 environmental 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

**DEPARTMENT OF COLLEGIATE EDUCATION
GOVERNMENT OF ANDHRA PRADESH**

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

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

Rc.No.1/ A.C/BOS/2023-24

Dt.29 Aug2023

Sub: P.R.G.C[A] – Academic Cell - **Conduct of BOS Meetings for the Academic Year2023-24** – Guidelines issued - Regarding.

Ref: Resolutions adopted in 25th Staff Council Meeting held on 29 Aug 2023

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 equip students with such skills that translate them into leaders and potential entrepreneurs too besides credit transfer mechanism through ABC (Academic Bank of Credits).

The HEIs are also, as per the Revised Accreditation Framework [RAF] of NAAC, endowed with the responsibility of rolling out quality and holistic human resources to the modern Indian Economy by ingraining quality in teaching- learning process by facilitating the students experience a wide range of participative and experiential learning strategies including field trips, conferences, integration of technology, community service programmes, career guidance, certificate and value added courses, research and inquisition based teaching, exchange programmes, gender equity programmes, etc.

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

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

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

ORDER:

In the light of the above mandate and responsibilities prescribed by institutions vision and mission, SDG-4, NEP – 2020, NAAC, NIRF to the autonomous HEIs, need to customize, design and re-orient their academic and research administration in tune with the policies of above bodies, our institution is no exception.

Hence, the Chairmen of U.G and P.G Boards of Studies of various Departments are requested to make necessary arrangements for the conduct of the meetings on **31 August 2023**. They are further requested to prepare curricula and extracurricular activities and devise suitable evaluation system keeping in mind above recommendations to make students a wholesome personality and a 21st century student capable of facing challenges, adaptive to changes, creative and innovative.

Further, the Chairman of the each BOS, in association with the IQAC coordinator, preceding the BOS meeting, is requested to prescribe benchmarking, quality initiatives in pedagogy and learning; in design of curriculum (with 20% change) and optimum utilization of existing human, physical and

ICT resources and adopt resolutions to the extent of benchmarks (As per SOP given in **Annexure – I**). Further, as the regular attendance of students to the classes is a deciding factor in enhancement of quality in learning, a minimum attendance of 60% for I mid-term examination, 75% for II mid-term examination under CIA component shall be the benchmark for attendance and it shall be approved in the BOS. The Chairmen are also requested to approve the new programmes to be introduced for 2023-24, if any, number of certificate courses, their frequency, Bloom 's- Taxonomy based evaluation system for effective learning outcomes as per the Annexure – I.

The Chairmen are, therefore, requested to

- Design curricula of Odd and even semesters for the A.Y 2023-24 both for U.G and P.G courses in tune with the stated vision, mission of the institution, RAF of NAAC, NEP-2020 and NIRF.
- Conduct meeting with employers, parents, alumni, shall take feedback on the existing curricula and 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.
- 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 draft of the curricula verified and approved by the Principal, Academic Cell and IQAC before the actual BOS meetings to ensure uniformity and commensurate with the stated vision and mission of the college among the departments.
- The Academic Cell coordinator shall be the Chief Coordinator for the BOS meeting activity and IQAC coordinator will be the additional coordinator.
- The Academic Coordinator and IQAC coordinator conducted a meeting with the Chairmen, BOS on 28 August 2023 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.500/-)
- The Chairman of each BOS shall apply to the principal for advance amount for meeting the BOS meetings with head-wise expenditure in the prescribed format (Annexure-III).

Following contents shall be presented in the BOS document in order

1. Proceedings of the Principal pertaining to BOS
2. Composition of BOS
3. Vision and Mission of the college
4. Agenda: It shall include ATR on the previous BOS meeting first, resolutions, etc., later.
5. Table showing the Allocation of Credits in the following table for both theory and Lab in case of 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)	Experiential learning component	Scope (Skill/ employability/ entrepreneurship)
1	III	Botany	Plant Physiology	Plant Cell	Knowledge	Shall be shown Microscope	
2	III	History	Tourism	Tourism management	Application	Apprenticeship	Employability

8. Each BOS Chairman shall, immediately after syllabus, tabulate the changes made in the syllabus/paper along with justification, in the Proforma given in Annexure – I.

9. Attendance of Members present with signatures in the tabular form.

10. List of Examiners & Paper setters

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 (2023-24 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 **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 any unit 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 any unit(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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- For II semester, 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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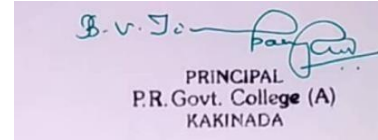
CIA structure for 3 Major system

- 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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- Percentage of syllabus changes in each paper
- Measure outcome attainment learning levels of students through direct and indirect methodology and mapping COs and POs
- Text & Reference Books
- e-content links.

Enclosures: Annexures- I, II & III Copy to:
Lecturers in-charge(BOS Chairmen) of
all the departments
Academic Coordinator
IQAC Coordinator
Controller of Examinations
Office.



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



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, sathupathi.sri@gmail.com
2	Hindi	Dr. N Venkata Ramana, SKBR College, Amalapuram, Ph. No: 9849373773
3	Telugu	Dr. P. Nagaraju, GDC, Palakollu, Ph.No: 9052038569, raju00517@gmail.com
4	Sanskrit	Dr. TGY Acharyulu, SKR Womens College, Rajahmundry, Ph. No: 9848628812
5	Mathematics	Dr. V. Anantha Lakshmi, Principal, GDC Pithapuram, Ph. No : 9963786386, ananthamaths@rediffmail.com
6	Statistics & Actuarial Sciences	Dr. D V Ramana Murthy, HoD of Statistics, SKVT College, Rajamahendravaram, Ph.No: 9949135864, drdvmurthy@gmail.com
7	Chemistry & Analytical Chemistry	Dr. K. Jhansi Lakshmi, Principal, Ideal College of Arts & Sciences, KKD, Ph.No: 9441236409, jhansikalisindi@gmail.com
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, suvarchakamallela@gmail.com
12	Botany	Dr. J. Sujatha, Leturer in Botany, GDC Rjy, Ph.No: 9441050910, drjsuneetha@gcrjy.ac.in
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, drmtm2011@gmail.com
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, asreenivasulu@gmail.com
17	Computer Science & Computer Applications	Mr. N. Naga Subrahmanyesweri, Lecturer in Computer Science, ASD Women's College, KKD, Ph. No: 9948438376, yesweri.velugu@asddgcw.ac.in
18	Commerce	Dr. K. Ratna Manikyam, Govt. College (A), RJY, Ph. No: 8919230362, drkrm@grjy.ac.in
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, drjsunectha@grjy.ac.in
25	Pharmaceutical Chemistry	Dr. K. Deepthi, Asst. Professor, Dept. of Chemistry, AKNU, Rjy, Ph. No: 9985469607, deepthikorabandi@gmail.com

(BY ORDERS)


Dean 22/10/21
ACADEMIC AFFAIRS

To
The Principal, PR Govt. College (A), Kkd
PA to R
PS to VC,
OOF

**Proceedings of the Principal, PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A):
Kakinada**

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

Rc.No.1/A.C./BOS/2023-24, Dated: 29 AUG 2023

**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. B.V.Tirupanyam 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 Reddy	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	Smt. I.Purnima Mahalakshmi	Faculty of the

		Department
12	Kmt.V.V.Lakshmi Devi	Faculty of the Department
13	Kmt.P.Chitti Sai Lakshmi	Faculty of the Department
14	B.Ajay Kumar	Student Alumni Member B.Sc(M.P.C-EM)
15	A.Syamala	Student Member II B.Sc –M.C.Cs
16	B. Sai Yaswanth	Student Member II B.Sc –M.S.Cs
17	G.Syam Prasad	Student Member III B.Sc –M.P.Cs
18	CH.Vara Lakshmi	Student Member III B.Sc –M.P.C (EM-II)

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 stake holders 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.



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KAKINADA

Copy to:

- The above individuals
- File

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A):: KAKINADA
DEPARTMENT OF MATHEMATICS

The Board of studies meeting for Mathematics subject during the academic year 2023 – 2024 conducted at the Dept.of Mathematics on 31-08-2023 at 10.00 Am with Dr.B.V.Tirupanyam, Principal, In-charge in Mathematics, the chair along with the following members.

S.No	Name with Designation and Address	Signature
1	Dr. B.V.Tirupanyam I/C of Mathematics P. R. Govt. College (A), Kakinada	B.V.Ti. Pan 31 Aug 2023
2	Dr. V.Anantha Lakshmi Principal, A.S.D.Govt degree college for women (A) , Kakinada	V. Anantha Lakshmi 31/8/23
3	i) Dr. P. Subhashini, Principal Government Degree College, Pithapuram . ii) Sri. K. Chittibabu, Lecturer in Mathematics, Government Degree College, Mummidivaram.	Subhashini K. Chittibabu 31/08/23
4	Sri. P. S. R. Subrahmanyam, Rtd. HOD of Mathematics, Ideal College of Arts & Science (A), Kakinada	
5	Sri. G .Syam Prasad Reddy	G. Syam . CS
6	Sri. G. Prasada Rao	G. Prasada Rao
7	Smt. K.S.I.Priyadarshini	K.S.I. Priyadarshini
8	Smt. L.S.B.R.Bhanu	L.S.B.R.Bhanu
9	Smt. K. Samrajyam	K. Samrajyam
10	Smt. N.S.S.Nagadevi	N.S.S. Nagadevi
11	Smt. I.Purnima Maha Lakshmi	I.P. Mahalakshmi
12	Kmt.V.V.Lakshmi Devi	V.V.L. Devi
13	Kmt.P.Chitti Sai Lakshmi	P. Chitti Sai Lakshmi
14	B.Ajay Kumar(Student Alumni Member)	B. Ajay Kumar
15	A.Syamala (II M.C.Cs)	A. Syamala
16	B. Sai Yaswanth (II M.S.Cs)	B. S. Yashwanth
17	G.Syam Prasad (III M.P.CS)	G. Syamprasad
18	CH. Vara Lakshmi (III M.P.C -EM II)	Ch. Varalakshmi

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

DEPARTMENT OF MATHEMATICS

Meeting of the Board of studies is held at 10AM on 31-08-2023 in the Department of Mathematics, P.R.Govt. College (A), Kakinada with the following agenda.

Agenda

1. a) To approve the curriculum, blue print and model paper for 1st year B.Sc Course under CBCS based as per the directions of the APSCHE for the admitted batch 2023 -24(I & II 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 2023 -24.(II Semester).
2. a) To approve the curriculum, blue print and model paper for 2nd year B.Sc Course under CBCS based as per the directions of the APSCHE for the admitted batch 2022 -23 (III & IV 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.(III & IV Semester).
3. To approve the curriculum, blue print and model paper for 3rd year B.Sc Course under CBCS based as per the directions of the APSCHE for the admitted batch 2021 -22(V Semesters)
4. To approve the two Certificate Courses, one for first year mathematics stream in second semester) (Vadik Mathematics) and another one is Competitive Mathematics for non-mathematics students were introduced in this academic year.
5. To approve the two Value added courses in Sem – IV and V. One is Laplace Transformation With Applications and another one is MATLAB.
6. 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.
7. To approve the Examination procedure for the courses for I, II, III years of B.Sc (2023 – 24, 2022-23& 2021-22 admitted batches).
a) 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.
b) Each student (2023-24 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 **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 any unit with more syllabus weightage

- 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	0	1
2	II	1	0	1
3	III	0	1	1
4	IV	0	1	1
5	V	0	1+ one question from any unit(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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- For II Semester, 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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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 credit to students who have registered and completed SWAYAM course successfully.
10. To award 4 credits for each first and second phase of Apprenticeship between 1st and 2nd year and 2nd and 3rd year (two summer vacations).
11. To implement pedagogical strategies to enrich teaching and learning process.
12. To approve the proposed departmental activities for 2023 – 24.
13. To approve the list of examiners and paper setters for the academic year 2023 – 24.
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 their for the studies.
- It is resolved to start a coaching to final year students for (CUET, APPGCET and other Exams).
- 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.

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 first semester of the first year, course – I & course – II papers were given as common to each Major. Mathematics, Physics, Chemistry and Computer departments have to thought these papers.

➤ **FIRST YEAR : COURSE-I & COURSE - II**

1. Introduced a new paper Essential and Applications of Mathematical, Physical and Chemical Sciences.
2. Introduced a new paper Advances in Mathematical, Physical and Chemical Sciences.
3. Introduced an Analytical skills paper for all major courses. The pattern of the Analytical Skills paper will be changed as all are MCQ.

➤ **FIRST YEAR : SECOND SEM – MAJOR & MINOR**

A. COURSE 3: DIFFERENTIAL EQUATIONS

1. Method-IV & V in Integrating factors are deleted

B. COURSE 4: ANALYTICAL SOLID GEOMETRY

1. Cones chapter completely shifted to Unit -V.

2. Condition that a cone may have three mutually perpendicular generators; Reciprocal cones are added.
3. Intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone;; Intersection of two cones with a common vertex are deleted.

➤ Practical exams will be included for the students joining the academic year 2023-24.

➤ **SECOND YEAR : COURSE-III**

1. Paper-III model can be changed

Section -I

Part -A : Given 3 questions

Part – B : Given 3 Questions

Write any 3 questions, at least 1 question from each Part. Each question carries 10 marks

Section – II

Write any 4 questions, out of 7 questions. Each question carries 5 marks.

2. The pattern of the Analytical Skills paper will be changed as all are MCQ.

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

➤ **SECOND YEAR : COURSE – IV**

1. Uniform continuity topic is added in Unit-III

2. Alternating Series – Leibnitz Test, Absolute Convergence and Conditional Convergence are deleted in Unit-II.

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

4. Paper-IV model can be changed

Section -I

Part -A : Given 3 questions

Part – B : Given 3 Questions

Write any 3 questions, at least 1 question from each Part. Each question carries 10 marks

Section – II

Write any 4 questions, out of 7 questions. Each question carries 5 marks.

Total 50 marks

➤ **SECOND YEAR : COURSE – V**

1. Rank of Matrices topic is added in Unit-IV.

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

3. Paper-V model can be changed

Section -I

Part -A : Given 3 questions

Part – B : Given 3 Questions

Write any 3 questions, at least 1 question from each Part. Each question carries 10 marks

Section – II

Write any 4 questions, out of 7 questions. Each question carries 5 marks.

Total 50 marks.

➤ **THIRD YEAR : COURSE – VI A**

1. Paper-VI A model can be changed

Section -I

Part -A : Given 3 questions

Part – B : Given 3 Questions

Write any 3 questions, at least 1 question from each Part. Each question carries 10 marks

Section – II

Write any 4 questions, out of 7 questions. Each question carries 5 marks.

Total 50 marks.

➤ **THIRD YEAR : COURSE – VII A**

1. Paper-VI A model can be changed

Section -I

Part -A : Given 3 questions

Part – B : Given 3 Questions

Write any 3 questions, at least 1 question from each Part. Each question carries 10 marks

Section – II

Write any 4 questions, out of 7 questions. Each question carries 5 marks.

Total 50 marks.

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 2023-24.
5. It is resolved to approve the list of examiners and paper setters for the academic year 2023-24.
6. Streamlining of regularity in attendance. Resolved to make the eligibility to appear for 1st mid is 75% of attendance for the 2nd 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 second 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 7th 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 31st AUG 2023.

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

BOS CHANGES FROM DEPARTMENT OF MATHEMATICS - ACADEMIC YEAR 2023-24


S.No.	Semester, Program	Paper Number & Paper Title	Titles of Topics deleted	Topics to be added during BOS meeting October 2022	Percentage of changes made in syllabus	Justification per each topic deleted	Justification per each topic added
1	I, Major	Course-I, Essentials and Applications of Mathematical, Physical and Chemical		Essentials and Applications of Mathematics	Newly Introduced		Understand the interplay and connections between mathematics, physics, and chemistry in various applications
2	I, Major	Course-II Advances in Mathematical, Physical and Chemical Sciences		Advances in basic Mathematics	Newly Introduced		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.
3	I, Skill Courses	Analytical Skills		Arithmetic ability, Quantitative aptitude, Data Interpretation	Newly Introduced in I semester		Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.
4	II, Major & Minor	Differential Equations	Method IV & V in Integrating factors		10%	Not much application oriented	
5	II, Major	Solid Geometry	Orthogonal projection on a plane. Simplified form of the equation of two spheres. Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Intersection of two cones with a common vertex.	Condition that a cone may have three mutually perpendicular generators; Reciprocal Cone	20%	In view of syllabus coverage more over these topics were covered in the previous chapter.	These topics added for the continuation of higher studies.
6	II Major & Minor	Diferential Equations		Practicals are Introduced	100%		Improve investigative skills, resourcefulness and creativity.
6	II Major	Solid Geometry		Practicals are Introduced	100%		Improve investigative skills, resourcefulness and creativity.
8	III, B.Sc all Groups	Abstract Algebra		Practicals are Introduced	100%		Improve investigative skills, resourcefulness and creativity.

9	IV, B.Sc all Groups	Real Analysis	Alternating Series – Leibnitz Test, Absolute Convergence and Conditional Convergence	Uniform Continuity	20%	In view of average and slow learners reduced the content	These topics added for the continuation of higher studies
10	IV, B.Sc all Groups	Real Analysis		Practicals are Introduced	100%		To motivate students to master math skills and problem solving techniques. It will improve the student's ability to learn mathematics.
11	IV, B.Sc all Groups	Linear Algebra		Rank of a matrix	20%		For furthestmost understanding of following next topics of the units.
12	IV, B.Sc all Groups	Linear Algebra		Practicals are Introduced	100%		Practical learning has the unique ability to help students apply their skills in a non- classroom environment.
13	II Semester	Certificate Course-I		Certificate course on Vedic Mathematics	Newly Introduced in II semester		Helps an individual to showcase his competency, commitment for the profession, build expertise in his professional subject area, and helps with job advancement.
14	V Semester Non- Mathematics Students	Certificate Course-II		Certificate course on Competitive Mathematics for Non- Mathematics Students	Newly Introduced in V semester		
15	III Semester Maths Stream	Value Added Course-I		Laplace Transformations with Applications	Newly Introduced in III semester		understand Laplace transforms of standard functions and Application
16	V Semester Maths Stream	Value Added Course-I		MATLAB	Newly Introduced in VI semester		To introduce students the use of a high-level programming language, MATLAB.


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Signature of the I/C of Department

S.No	Parameter	Unit of Time	Benchmarking (Number/ quantity)	Remarks
1	Certificate courses	Semester-II ,V	2	
2	Value added courses	Semester -IV,V	2	
3	MOOCs for student	Year -2023-24	Each student (2023-24 AB)has to complete one MOOCS course from SWAYAM in any subject per year which is mandatory.	
4	MOOCs for faculty	Semester	10 (Each faculty one course per year)	
5	LMS by faculty	Semester	10 (Each faculty one topic in each semester)	Each faculty shall prepare topic wise/ chapter wise LMS (4- quadrant approach)
6	Field/ industrial/ Educational trips	Year 2023-24	1	Department level – Each dept shall conduct
7	Research papers	Year	2	Minimum one research publication per year per lecturer
8	Conferences/ Workshops/ – National level	Year 2023-24	1	Offline (Preferably one month after commencement of odd/ even semester)


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Signature of the I/C of Department

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

ACTION PLAN FOR THE ACADEMIC YEAR 2023-2024

Department of Mathematics

S.No	Month	Week	Item as approved in BOS and to be incorporated in AC meeting agenda as Institution Plan	Outcome of the activity
1	September	I	Teacher's Day	To knowledge the challenges, hardship and special roles that teachers play in our lives. The competitive spirit will be improved.
		II	Quiz Computation	
2	October	III	National Conference	Learning and knowledge exchange among Conference participants through interdisciplinary discussions.
3	November	II	Field Trip	It's providing real-world experience, increases the quality of education and improves the social relations.
4	December	II	Town level Quiz and Elocution computations.	The competitive spirit will be improved among the students. The students will be motivated to pursue higher education in Mathematics.
		III	Celebration of Mathematics Day on 22 nd Dec-2023.	
5	December	IV	Seminar on Professional Ethics for HEI teaching.	Professional ethics renders a significant contribution in preparing the individuals for different opportunities.
6	January	IV	Community outreach Programmes	To developed and enhanced the subject's academic skills, leadership qualities and responsibilities toward the rural community.
7	February	IV	Science Day Celebrations.	Students will get more interest to do projects and there is a scope to know the applicability of all subjects.
8	March	II	π Day celebrations Carrier Guidance	To impart the knowledge on the significance of π
9	April	I	Mathematics Guest lecture.	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 2023 -24

LIST OF EXAMINERS & PAPER SETTERS IN MATHEMATICS

S.No.	Name of the Lecturer	Address
1	Dr. D. Sai Baba	Lecturer in Mathematics, Sri.ASNM Govt college (A),Palkolu
2	Dr. Ch. Srinivas	Lecturer in Mathematics, Government College (A), Rajamahendravaram - 9948617181
3	Sri. K. Chitti Babu	Lecturer in Mathematics, Government Degree College, Mummidivaram. 9493654033
4	Dr. V.S. Patnayak	Lecturer in Mathematics, M.R College, Vizaianagaram
5	Sri. K. Kameswara Rao	Lecturer in Mathematics, Government Degree College, Pithapuram - 9866219121
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	M. Madhavi	Lecturer in Mathematics, Government Degree College, Tuni. 9247380632

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

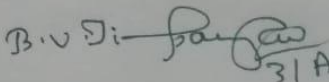
DEPARTMENT OF MATHEMATICS

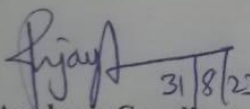
Certificate of Submission

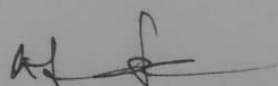
The following documents are submitted to the academic coordinator and controller of Examination.

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

B.V. Di 
31 Aug 2023
(B.V. TIRUPANYAN)


31/8/23
Academic Coordinator


Controller of Examinations

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	
I	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	5 Hrs (3T + 2P)	3 + 1	50	50	100	50
		IV (Major)	Analytical Solid Geometry & Problem	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
II	Sem III	III	Abstract Algebra	6 Hrs (4T + 2P)	5	50	50	100	50
		Life Skill Course:	Analytical Skills	2 Hrs	2	-	50	50	-
	Sem IV	IV	Real Analysis	6 Hrs (4T + 2P)	5	50	50	100	50
		V	Linear Algebra	6 Hrs (4T + 2P)	5	50	50	100	50
III	Sem V	VI A	(To choose One pair from the Three alternate pairs) Numerical Methods	6 Hrs	5	50	50	100	-
		VII A	Mathematical Special Functions	6 Hrs	5	50	50	100	-
			OR						
		VI B	Multiple integrals and Applications of Vector Calculus	6 Hrs	5	50	50	100	-
		VII B	Integral transforms with Applications	6 Hrs	5	50	50	100	-
			OR						
VI C	Partial Differential Equations and Fourier Series	6 Hrs	5	50	50	100	-		

		VII C	Number theory	6 Hrs	5	50	50	100	-
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Total number of hours for each paper in the academic year 2023-2024:

Paper I & II :

Paper III :

Paper IV & V :

Paper VIA : 36

Paper VII A : 36

Analytical Skills :

(Skill & Foundation Course)

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 APSICHE 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(6th Semester Period):**

During the entire 6th 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).

➤ **Credit For Course:12 for 200 marks**

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.

Knowledge and Understanding:-

On completion of this programme the successful student will have knowledge and understanding of

- Core areas of pure mathematics including geometry, algebra, mathematical analysis and discrete mathematics.
- Core areas of applied mathematics including statistics, operational research and differential equations.
- Several specialized areas of advanced mathematics and its applications.
- The correct use of mathematical language to express both theoretical concepts and logical arguments.
- The use of computers both as an aid and as a tool to study problems in mathematics.

Cognitive (thinking) Skills:-

On completion of this programme the successful student will be able to

- To formulate problems in appropriate theoretical frameworks to facilitate their solution.
- To develop strategies to solve mathematical problems in a range of relevant areas.

- To construct logical arguments solving abstract or applied mathematical problems.
- To criticise mathematical arguments developed by themselves and others.

Practical Skills:-

On completion of the programme the successful student will be able

- To solve practical problems in a range of areas of mathematics.
- To determine the appropriateness of different methods of solving mathematical problems.
- To communicate mathematics effectively to a wide range of audiences.
- To use computer packages where appropriate to develop a deeper understanding of mathematical problems.

Graduate Skills:-

On completion of this programme the successful student will be able

- To work effectively and constructively as part of a team.
- To motivate and communicate complex ideas accurately using a range of formats.
- To identify and benefit from opportunities for personal and career development.
- To work confidently and accurately with formulae and numerical information.

Programme Specific Outcomes of Mathematics Stream Courses

PROGRAMME	Program Specific Outcomes
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 Equipments.
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

S. No.	Sem. No.	Domain Specific course/Clusters	Title
1	I	Major	Essential and Applications of Mathematical, Physical and Chemical Sciences
2	I	Major	Advances in Mathematical, Physical and Chemical Sciences
3	II	Major & Minor	Differential Equations
4	II	Major	Solid Geometry
5	III	General Core	Abstract Algebra
6	IV	General Core	Real Analysis
7		General Core	Linear Algebra
8	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	<p>CO 1. solve first order first degree linear differential equations.</p> <p>CO 2. convert a non-exact homogeneous equation to exact differential equation by using an integrating factor</p> <p>CO 3. know the methods of finding solution of a differential equation of first order but not of first degree</p> <p>CO 4. solve higher-order linear differential equations for both homogeneous and non-homogeneous, with constant coefficients.</p> <p>CO 5. understand and apply the appropriate methods for solving higher order differential equations</p>
	II	Analytical Solid Geometry	<p>CO 1. understand planes and system of planes.</p> <p>CO 2. know the detailed idea of lines.</p> <p>CO 3. understand spheres and their properties.</p> <p>CO4. know system of spheres and coaxial system of spheres.</p> <p>CO 5. understand various types of cones.</p>
II	III	Abstract Algebra	<p>CO 1. To analyse the abstract algebraic concept Group theory.</p> <p>CO 2. To understand the concepts in group theory like groups, subgroups, normal subgroups, permutation groups and cyclic groups with examples.</p> <p>CO 3. To understand the theorems on these concepts and also to solve problems on it.</p> <p>CO 4. To analyse and understand the applications of group theory in various fields.</p> <p>CO 5. To understand the ring theoretic concepts with the help of knowledge in group theory and to prove the theorems on it.</p> <p>CO 6. To understand the applications of ring theory in various fields.</p>
	IV	Real Analysis	<p>CO 1. To get clear idea about the real numbers and real valued functions.</p>

			<p>CO 2. To obtain the skills of analyzing the concepts and applying appropriate methods for testing converges of a sequence or series.</p> <p>CO 3. To analyse the concepts of continuity, differentiability and Riemann integrability of a function and also to gain the skills about how to test these conditions of functions defined on the subsets of the real line.</p> <p>CO4. To know the Geometrical interpretation of mean value theorems.</p>
		Linear Algebra	<p>CO 1. To understand the different concepts of linear algebra.</p> <p>CO 2. To analyse the concepts of vector space, subspace and homomorphism between them.</p> <p>CO 3. To understand how to solve the system of linear equations and this concept used in balancing of chemical equations.</p> <p>CO 4. To analyse the concepts of eigen values, inner product spaces and orthogonality and also gain the problem solving ability on them.</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) n, also find the generating function for</p>

			<p>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 n, 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 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>

		CO 5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.
	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 $f(x)$ 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 n.</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 p and quadratic non residues mod p.</p>	

COURSE 1
SEMESTER-I

**ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND
CHEMICAL SCIENCES**

Hours: 5hrs/week

Credits: 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:

9hrs

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:

9hrs

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: 9hrs

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: 9hrs

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

12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

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
2. your college network) and prepare a report covering network architecture.
3. Identify the types of malwares and required firewalls to provide security.
4. Latest Fraud techniques used by hackers.

COURSE 2

SEMESTER-I

Title of the Course

ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Hours: 5 hrs/week

Credits: 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

9hrs

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:

9hrs

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:

9hrs

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

9hrs

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

9hrs

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.

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.

	P.R. Government College (Autonomous) KAKINADA	Program & Semester FOR ALL MAJOR SUBJECTS (I Sem)			
Course Code	TITLE OF THE COURSE Analytical Skills				
Teaching	Hours Allocated: 30 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge	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
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	2	3	3	1	1	3	1	2

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

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

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

P.R. 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

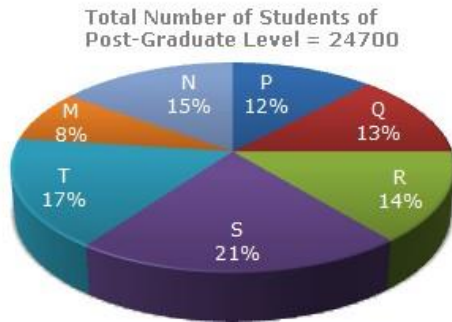
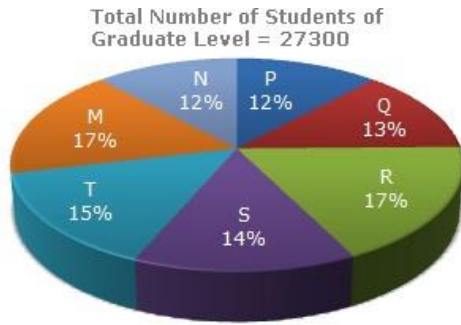
- a) **Monday** b) Wednesday c) Tuesday d) Friday

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?

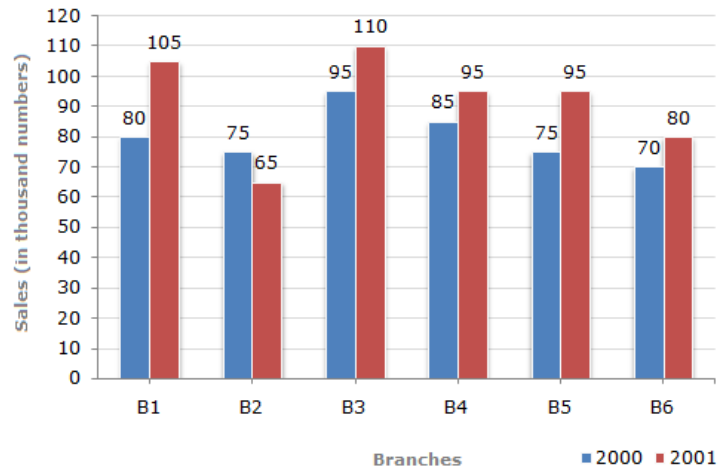
A. 7516 **B. 8463** C. 9127 D. 9404
4. What is the ratio between the number of students studying at post-graduate level from institutes S and the number of students studying at graduate level from institute Q?

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.



- 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**
- 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%
- 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%**
- What is the average sales of all the branches (in thousand numbers) for the year 2000?
A. 73 **B. 80** C. 83 D. 88
- 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

- Explain the divisibility rules .
 - Explain the BODMAS rule.
 - Explain the types of Ratio and Proportion .
 - Explain simple and compound interest .
 - 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.*

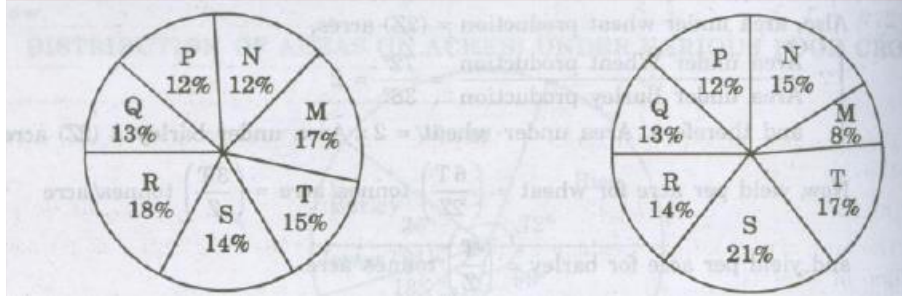
DISTRIBUTION OF STUDENTS AT GRADUATE AND POST-GRADUATE LEVELS IN SEVEN INSTITUTES-M,N,P,Q,R,S AND T.

Total Number of students of


Total Number of students of

graduate level 27300

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?

	P.R. Government College (Autonomous): KAKINADA	Program & Semester Major & Minor (II Sem) w.e.f. 2023-24 admitted Batch			
Course Code MAT-201	TITLE OF THE COURSE Differential Equations & Problem Solving Session				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge	3	0	0	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-	
CO1	Solve linear differential equations
CO2	Convert non - exact homogeneous equations to exact differential equations by using integrating factors.
CO3	Know the methods of finding solutions of differential equations of the first order but not of the first degree.
CO4	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-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	2	3	3	1	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-I, DIFFERENTIAL EQUATIONS

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
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
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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P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
I year B.Sc., Degree Examinations - I Semester
Mathematics Course-I: Differential Equations
(w.e.f. 2023-234Admitted Batch)
Model Paper (w.e.f. 2023-2024)

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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. Solve $(1 + xy)x dy + (1 - xy)ydx = 0$.
2. Solve $\frac{dy}{dx}(x^2y^3 + xy) = 1$
3. Solve $p^2 + 2py \cot x = y^2$


Part - B

4. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.
5. Solve $(D^2 - 4D + 4)y = 8x^2 e^{2x} \sin 2x$
6. Solve $[(1+x)^2 D^2 + (1+x)D + 1]y = 4 \cos \log(1+x)$.

Section II

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

7. Solve $(y - e^{\sin^{-1}x}) \frac{dx}{dy} + \sqrt{1-x^2} = 0$
8. Solve $(e^y + 1) \cos x dx + e^y \sin x dy = 0$.
9. Find the Orthogonal trajectories of family of curves $r = a(1 + \cos \theta)$.
10. Solve $(py + x)(px - y) = 2p$.
11. Solve $(D^2 - 3D + 2)y = \cosh x$.
12. Solve $(D^2 - 2D + 1)y = x^2 e^{3x}$.
13. Solve $(D^2 + 1)y = \sec x$ by method of variation of parameters.

	P.R. Government College (Autonomous) KAKINADA	Program & Semester I Major & Minor (II Sem) w.e.f.2023-24 admitted Batch			
	Course Code MAT-101P	TITLE OF THE COURSE Differential Equations & Problem Solving Sessions Practical Course			
Teaching	Hours Allocated:30(Practical's)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge	-	-	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.

**BLUE PRINT FOR PRACTICAL PAPER PATTERN
COURSE-I, DIFFERENTIAL EQUATIONS**

Unit	TOPIC	E.Q	Marks allotted to the Unit
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
Total		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.

P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
I year B.Sc., Degree Examinations - I Semester
Mathematics Course-I: Differential Equations
(w.e.f. 2023-24 Admitted Batch)
Practical Model Paper (w.e.f. 2023-2024)

Time: 2Hrs
50M

Max. Marks:

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

5 x 6 = 30 Marks

SECTION - A

1. Solve $\frac{dy}{dx}(x^2y^3 + xy) = 1$

2. Solve $x^2y dx - (x^3 + y^3)dy = 0$.

3. Show that the family of confocal conics $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$ is self-orthogonal, where λ

is the Parameter.

4. Solve $2px = 2 \tan y + p^3 \cos^2 y$

SECTION - B

5. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.


6. Solve $(D^2 - 4D + 4)y = 8x^2 e^{2x} \sin 2x$

7. Solve $(D^4 + 2D^2 + 1)y = x^2 \cos x$

8. Solve $[(1+x)^2 D^2 + (1+x)D + 1]y = 4 \cos \log(1+x)$.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II Major (II Sem) w.e.f. 2023-24 admitted Batch			
Course Code MAT-202	TITLE OF THE COURSE Analytical Solid Geometry & Problem Solving Sessions				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on number system.	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-	
CO1	Get the knowledge of planes.
CO2	Basic idea of lines, sphere and cones.
CO3	Understand the properties of planes, lines, spheres and cones.
CO4	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 - Number of arbitrary constants in the equations of straight line - Sets of conditions which determine a line - 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, Condition that a cone may have three mutually perpendicular generators; Reciprocal Cone.

Co-Curricular Activities:

Seminar/ Quiz/ Assignments/Threedimensional 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-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	2	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	1	2	3	2	2	3
CO4	3	2	3	2	1	2	3	3	1	2	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	The Plane	1	2	25
II	The Line	1	1	15
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

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P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
I year B.Sc., Degree Examinations - II Semester
Mathematics Course-II: Three Dimensional Analytical Solid Geometry
(w.e.f. 2023-24 Admitted Batch)
Model Paper (w.e.f. 2023-2024)

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. Find the planes bisecting the angles between the planes $2x - y + 2z + 3 = 0$ and $3x - 2y + 6z + 8 = 0$. Point out which of the planes bisects the acute angle and which bisects the obtuse angle in which the origin lies.
2. Prove that the equation represents a pair of planes , and find the angle between them .
 $6x^2 + 4y^2 - 10z^2 + 3yz + 4zx - 11xy = 0$
3. Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of intersection and the plane containing the lines.

Part - B


4. Find the equation of the sphere passing through the circle $x^2+y^2=4$, $z=0$ and is intersected by the plane $x+2y+2z=0$ in circle of radius 3 .
5. Find the limiting points of the coaxial system of spheres determined by $x^2 + y^2 + z^2 + 4x - 2y + 2z + 6 = 0$, $x^2 + y^2 + z^2 + 2x - 4y + 2z + 6 = 0$.
6. Find the equation to the right circular cone whose vertex is P(2,-3,5) and axis PQ which makes equal angles with the axis and which passes through A(1,-2,3).

Section II

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

7. If a plane meets the coordinate axes in A, B, C such that the centroid of the triangle ABC is the point (p, q, r) then show that the equation of the plane is $\frac{x}{p} + \frac{y}{q} + \frac{z}{r} = 3$.
8. Find the image of the point (2, -1, 3) in the plane $3x - 2y + z = 9$.

9. A plane passes through a fixed point (a, b, c) and intersect the axes in A, B, C . Show that the centre of the sphere $OABC$ lies on $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 2$
10. Find the centre and radius of the circle $x^2 + y^2 + z^2 - 2y - 4z - 11 = 0$, $x + 2y + 2z - 15 = 0$.
11. Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at $(1, -2, 1)$ and cuts orthogonally the sphere $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$.
12. Show that the general equation of the cone of the second degree which pass through Coordinate axes is $fyz + gzx + hxy = 0$.
13. Find the enveloping cone at the $(1, 1, 1)$ and generators touching the sphere $x^2 + y^2 + z^2 - 2x + 4z - 1 = 0$

	P.R. Government College (Autonomous): KAKINADA	Program & Semester I B.Sc. (II Sem) w.e.f 2023-24 admitted batch			
Course Code MAT-201P	TITLE OF THE COURSE Analytical Solid Geometry & Problem Solving Sessions Practical Course				
Teaching	Hours Allocated: 30 (Practical)	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.

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-II, THREEDIMENSIONAL ANALYTICAL SOLID GEOMETRY

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

P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
I year B.Sc., Degree Examinations - I Semester
Mathematics Course-I: Differential Equations
(w.e.f. 2023-24 Admitted Batch)
Practical Model Paper (w.e.f. 2023-2024)

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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. Find the planes bisecting the angles between the planes $2x - y + 2z + 3 = 0$ and $3x - 2y + 6z + 8 = 0$. Point out which of the planes bisects the acute angle and which bisects the obtuse angle in which the origin lies.
2. Show that the equation $x^2 + 4y^2 + 4z^2 + 8yz + 4zx + 4xy - 9x - 18y - 18z + 18 = 0$ represents a pair of parallel planes and find the distance between them.
3. Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of intersection and the plane containing the lines.
4. Find the length and equation of the shortest distance between the lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{1}$ and $x + y + 2z - 3 = 0 = 2x + 3y + 3z - 4$.

SECTION - B

5. Find the equation of the sphere passing through the circle $x^2 + y^2 = 4$, $z=0$ and is intersected by the plane $x+2y+2z=0$ in circle of radius 3 .
6. Find the radical centre of the spheres $x^2 + y^2 + z^2 + 4y = 0$, $x^2 + y^2 + z^2 + 2x + 2y + 2z + 2 = 0$, $x^2 + y^2 + z^2 + 3x - 2y + 8z + 6 = 0$, $x^2 + y^2 + z^2 - x + 4y - 6z - 2 = 0$.
7. Prove that if the angle between the lines of intersection of the plane $x + y + z = 0$ and the cone $ayz + bzx + cxy = 0$ is $\pi/2$, then $a + b + c = 0$ and is $\pi/3$, if $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$.
8. Find the vertex of the cone $7x^2 + 2y^2 + 2z^2 + 10zx + 10xy + 26x - 2y + 2z - 17 = 0$.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc. (III Sem)			
Course Code MAT-301/3201	TITLE OF THE COURSE Abstract Algebra				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets and number system.	4	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-	
CO1	Acquire the basic knowledge and structure of groups, subgroups and cyclic groups.
CO2	Get the significance of the notation of a normal subgroups.
CO3	Understand the ring theory concepts with the help of knowledge in group theory and to prove the theorems.
CO4	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 :

(12 Hours)

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:

(12 Hours)

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. **Co-sets and Lagrange’s Theorem:** Cosets Definition-properties of Cosets–Index of a subgroups of a finite groups–Lagrange’s Theorem.

UNIT III:

(12 Hours)

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 –quotient group – criteria for the existence of a quotient group.

HOMOMORPHISM : 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 IV:

(12 Hours)

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

UNIT V:

(12 Hours)

RINGS

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings,Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings.

Co-Curricular Activities(15 Hours)

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

TEXT BOOK :

1. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published by S.Chand & Company, New Delhi.

REFERENCE BOOKS :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna.
3. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan.

Additional Inputs :

Cyclic Groups, Maximal Ideals and Prime Ideals .

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

BLUE PRINT FOR QUESTION PAPER PATTERN

SEMESTER-III

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Groups	2	2	20
II	Subgroups , Co-sets and Lagrange’s Theorem	2	1	20
III	Normal subgroups, Homomorphism	1	1	15
IV	Permutations.	1	1	15
V	Rings	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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P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester
Mathematics Course: Abstract Algebra
Paper III (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 – I

3 X 10 = 30

1. A finite semi –Group (G, \cdot) satisfying the cancellation laws is a group.
2. Show that the set Q_+ of all positive rational numbers forms an abelian group under the composition defined by ‘ \circ ’ such that $a \circ b = (ab)/3$ for $a, b \in Q_+$
3. Prove that a non empty complex H of a group G is a subgroup of G if and only if $a, b \in H \Rightarrow ab^{-1} \in H$.

Part – II


4. State and prove fundamental theorem on homomorphisms of groups
5. State and prove Cayley’s theorem.
6. Prove that the ring of integers Z is a principal ideal ring.

SECTION-B

Answer any four questions

4 X 5 M = 20 M

7. Prove that in a group $G (\neq \emptyset)$, for $a, b, x, y \in G$, the equations $ax = b, ya = b, \forall a, b \in G$ have unique solutions.
8. If G is a group, for $a, b \in G$ prove that $(ab)^{-1} = b^{-1}a^{-1}$
9. If a non-empty complex H of a group G is a subgroup of G then prove that $H = H^{-1}$.
10. If G is a finite group and $a \in G$ then show that $O(a)$ divides $O(G)$.
11. Define Normal subgroup. Prove that a subgroup H of a Group (G, \cdot) is a normal subgroup of G if and only if $xHx^{-1} = H \forall x \in G$.
12. Verify whether the permutation $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 2 & 5 & 4 & 3 & 6 & 1 & 7 & 9 & 8 \end{pmatrix}$ is even or odd.
13. Prove that, a ring R has no zero divisors iff the cancellation laws hold in R .

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc. (III Sem)			
Course Code MAT-301P	TITLE OF THE COURSE Abstract Algebra				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets and number system.	-	-	2	1

UNIT I :

(12 Hours)

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:

(12 Hours)

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. **Co-sets and Lagrange's Theorem:** Cosets Definition-properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

UNIT III:

(12 Hours)

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 –quotient group – criteria for the existence of a quotient group.

HOMOMORPHISM : 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 IV:

(12 Hours)

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

UNIT V:

(12 Hours)

RINGS

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings.

TEXT BOOK :

1. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published by S.Chand & Company, New Delhi.

REFERENCE BOOKS :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna.
3. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan.

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-III, ABSTRACT ALGEBRA

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

P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
Ilyear B.Sc., Degree Examinations - III Semester
Mathematics Course-III: ABSTRACT ALGEBRA
(w.e.f. 2022-23 Admitted Batch)
Practical Model Paper (w.e.f. 2022-2023)

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Time: 2Hrs

Max. Marks: 50M

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

5 x 6 = 30 Marks

SECTION - A


1. Show that the set of rational numbers other than 1 with operation $*$ such that $a * b = a + b - ab \forall a, b \in Z$ is an abelian groups.
2. Prove that a finite semi-group (G, \cdot) satisfying the cancelation laws is a group
3. Prove that a non empty complex H of a group G is a subgroup of G if and only if $a, b \in H \Rightarrow ab^{-1} \in H$, where b^{-1} is the inverse of b in G .
4. If H and K be two sub-groups of a group g then $H \cup K$ is a sub-group iff either $H \subseteq K$ or $K \subseteq H$

SECTION - B

5. Prove that H is a normal sub-group of G if and only if product of two right right (left) cosets of H in G is again a right (left) coset of H on G .
6. Prove that a sub-group of index 2 in a group is a normal sub-group.
7. $f = (1\ 2\ 3\ 4\ 5\ 6\ 7\ 8)$, $g = (4\ 1\ 5\ 6\ 7\ 3\ 2\ 8)$ are cyclic permutations. Show that $(fg)^{-1} = g^{-1}f^{-1}$.
8. Prove that the set $Z(i) = \{a + ib : a, b \in Z, i^2 = -1\}$ of Gaussian integers is an Integral domain with respect to addition & multiplication of numbers is a field.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc (III Sem)			
Course Code SDC-AS/3023	TITLE OF THE COURSE Analytical Skills				
Teaching	Hours Allocated: 30 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge	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:

4. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
5. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
6. 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
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	2	3	3	1	1	3	1	2

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

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

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

P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester
Foundation course: Analytical Skills
(Model Paper w.e.f. 2021-22)

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**

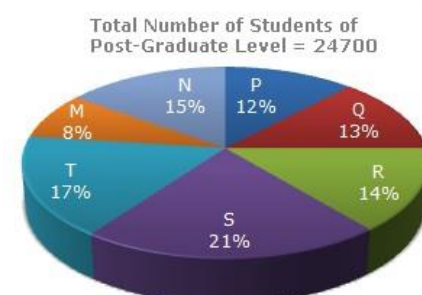
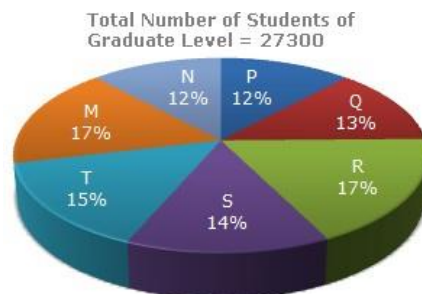
19. The compound interest accrued on an amount at the end of 2 yr at the rate of 12% p.a. is Rs.2862 . What is the amount ?

- 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%

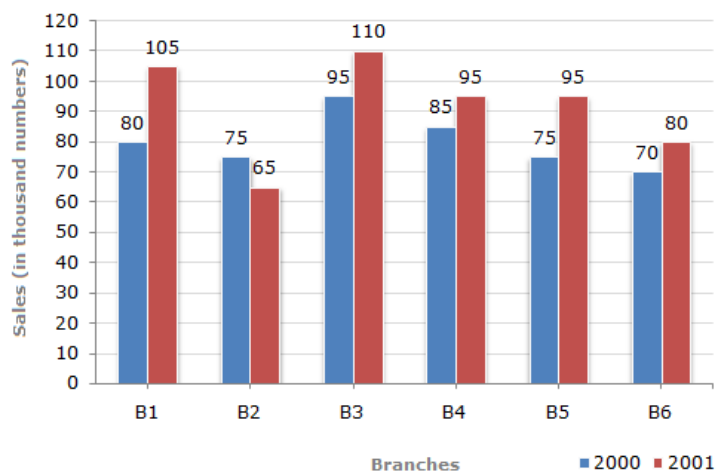
21. The following pie-charts show the distribution of students of graduate and post-graduate levels in seven different institutes in a town. **Distribution of students at graduate and post-graduate levels in seven institutes:**



3. What is the total number of graduate and post-graduate level students in institute R?
 B. 8320 B. 7916 C. 9116 **D. 8099**
4. What is the ratio between the number of students studying at post-graduate and graduate levels respectively from institute S?
 B. 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.



6. What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?
 B. 2:3 B. 3:5 C. 4:5 **D. 7:9**
7. 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%
8. 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?
 B. 75% B. 77.5% C. 82.5% **D. 87.5%**
9. What is the average sales of all the branches (in thousand numbers) for the year 2000?
 A. 73 **B. 80** C. 83 D. 88
10. 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

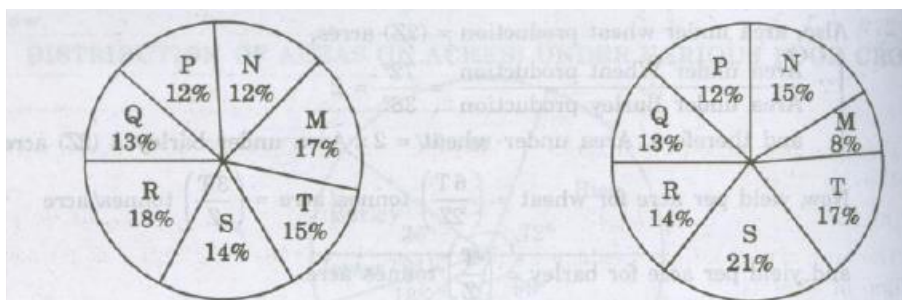
1. Explain the divisibility rules .
2. Explain the BODMAS rule.
3. Explain the types of Ratio and Proportion .
4. Explain simple and compound interest .
5. Explain the Venn diagrams .

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?

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc. (IV Sem)			
Course Code MAT-401/4201	TITLE OF THE COURSE Real Analysis				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on number system.	4	1	-	4

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	Get clear idea about the real numbers and real valued functions.
CO2	Obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/ series.
CO3	Test the continuity and differentiability and Riemann integration of a function.
CO4	Know the geometrical interpretation of mean value theorems.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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UNIT I

(12 Hours)

Introduction of Real Numbers (No question is to be set from this portion)

Real Sequences: 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, Subsequences, Cauchy Sequences – Cauchy's general principle of convergence theorem.

**UNIT II:
INFINITE SERIES :**

(12 Hours)

Series : Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. P-test
2. Cauchy's n^{th} root test or Root Test.
3. D'Alembert's Test or Ratio Test.

**UNIT III:
CONTINUITY:**

(12 Hours)

Limits: 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: Continuous functions, Combinations of continuous functions, Continuous Functions on interval, Uniform Continuity.

UNIT IV:

(12 Hours)

DIFFERENTIATION AND MEAN VALUE THEOREMS: The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem.

UNIT V:

(12 Hours)

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, First mean value Theorem.

Co-Curricular Activities

(15 Hours)

Seminar/ Quiz/ Assignments/ Real Analysis and its applications / Problem Solving.

TEXT BOOK:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, published by John Wiley.

REFERENCE BOOKS:

1. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.
2. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi

Additional Inputs :

Taylor's Theorem , McLaren theorem .

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 Sequences	1	1	15
II	Infinite Series	2	2	30
III	Continuity	2	1	20
IV	Differentiation And Mean value theorems	1	1	15
V	Riemann Integrations	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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P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester
Mathematics Course: REAL ANALYSIS
Paper IV (Model Paper w.e.f. 2023-24)

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. Show that a monotonic sequence is convergent iff it is bounded.
2. State and prove Cauchy's n^{th} root test.
3. State and prove Leibnitz test.

Part – B


4. State and Prove Intermediate value theorem.
5. State and Prove Role's theorem.
6. State and prove fundamental theorem of Integral Calculus.

SECTION-B

Answer any four questions

4 X 5 M = 20 M

1. Prove that every convergent sequence is a Cauchy sequence
2. If $\sum u_n$ converges absolutely then prove that $\sum u_n$ converges.
3. Test for the convergence of $\sum_{n=1}^{\infty} \frac{1.3.5 \dots (2n-1)}{2.4.6 \dots 2n} x^{n-1}$ ($x > 0$)
4. Examine for continuity the function f defined by $f(x) = |x| + |x - 1|$ at 0 and 1
5. Show that $f: R \rightarrow R$ defined by $f(x) = 1$ if $x \in Q$; $f(x) = -1$ if $x \in R - Q$ is discontinuous for all $x \in R$.
6. Show that $f(x) = x \sin(1/x)$, $x \neq 0$; $f(x) = 0$, $x = 0$ is continuous but not derivable at $x = 0$.
7. By considering the integral $\int_0^1 \frac{1}{1+x} dx$ show that $\log 2 = \lim_{n \rightarrow \infty} [\frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{2n}]$

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc. (IV Sem)			
Course Code MAT-401P	TITLE OF THE COURSE Real Analysis				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on number system.	-	-	2	1

UNIT I

(12 Hours)

Introduction of Real Numbers (No question is to be set from this portion)

Real Sequences: 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, Subsequences, Cauchy Sequences – Cauchy's general principle of convergence theorem.

UNIT II:

(12 Hours)

INFINITE SERIES :

Series : Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

4. P-test

5. Cauchy's n^{th} root test or Root Test.

6. D'Alembert's Test or Ratio Test.

UNIT III:

(12 Hours)

CONTINUITY:

Limits: 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: Continuous functions, Combinations of continuous functions, Continuous Functions on interval, Uniform Continuity.

UNIT IV:

(12 Hours)

DIFFERENTIATION AND MEAN VALUE THEOREMS: The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem.

UNIT V:

(12 Hours)

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, First mean value Theorem.

TEXT BOOK:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, published by John Wiley.

REFERENCE BOOKS:

3. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.
4. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi

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-IV, REAL ANALYSIS

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Real Sequences	1	06
II	Infinite Series	2	12
III	Continuity	1	06
IV	Differentiation And Mean value theorems	2	12
V	Riemann Integrations	2	12
	Total	08	48

P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
IIyear B.Sc., Degree Examinations - IV Semester
Mathematics Course-IV: REAL ANALYSIS
(w.e.f. 2022-23 Admitted Batch)
Practical Model Paper (w.e.f. 2023-2024)

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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. Prove that the sequence $\{s_n\}$ defined by $s_n = 1 + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!}$ is convergent.
2. Examine the convergence of $\sum_{n=1}^{\infty} (\sqrt{n^3 + 1} - \sqrt{n^3})$.
3. Test for convergence of $\sum_{n=1}^{\infty} (-1)^n \frac{1}{n} (1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n})$.
4. If $f: [a, b] \rightarrow R$ is continuous on $[a, b]$, then f is bounded on $[a, b]$ and attains its bounds or infimum and supremum

SECTION – B

7. Find c of Cauchy's mean value theorem for $f(x) = \sqrt{x}$, $g(x) = \frac{1}{\sqrt{x}}$ in $[a, b]$ where $0 < a < b$.
5. Show that $\frac{v-u}{1+v^2} < \tan^{-1}v - \tan^{-1}u < \frac{v-u}{1+u^2}$ for $0 < u < v$. Hence deduce that $\frac{\pi}{4} + \frac{3}{25} < \tan^{-1} \frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$
6. If $f(x) = x^2 \forall x \in [0, 1]$ and $P = \{0, 1/4, 2/4, 3/4, 1\}$, then find $U(P, f)$ and $L(P, f)$.
7. Prove that $\frac{\pi^3}{24} \leq \int_0^{\pi} \frac{x^2}{5+3 \cos x} dx \leq \frac{\pi^3}{6}$.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc. (IV Sem)			
Course Code MAT- 402/4225	TITLE OF THE COURSE Linear Algebra				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Abstract Algebra.	4	1	-	4

Course Objectives:

This course will cover the analysis and implementation of algorithms used to solve linear algebra problems in practice. This course will enable students to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subject.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01	Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
C02	Understand the concepts of linear transformations and their properties.
C03	Apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods.
C04	Learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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Unit - I: Vector Spaces – I (12 Hrs)

Vector spaces, General properties of vector spaces, n-dimensional vectors, Addition and scalar multiplication of vectors, Internal and external composition, Null Space, Vector Subspaces, Algebra of subspaces, Linear sum of two subspaces, Linear combination of vectors, Linear span, Linear dependence and linear independence of Vectors.

Unit - II: Vector spaces – II (12 Hrs)

Basis of vector space, Finite dimensional vector space, Basis extension, Co-ordinates, Dimension of vector space, Dimension of subspace, Quotient space and Dimension of Quotient space.

Unit - III: Linear transformations**(12 Hrs)**

Linear transformations, Linear operators, Properties of linear transformation, Sum and product of linear transformations, Algebra of Linear Operators, Range space and Null Space of LT, Rank and Nullity of a LT, Rank & Nullity theorem.

Unit - IV: Matrix**(12 Hrs)**

Rank of a Matrix, Linear Equations, Characteristic Values and Characteristic Vectors of square matrix – Cayley - Hamilton Theorem.

Unit - V: Inner Product Space**(12 Hrs)**

Inner Product spaces, Euclidean and Unitary spaces, Norm or length of a vector, Schwartz's inequality, Triangle Inequality, Parallelogram law, Orthogonality and orthonormal set, Complete orthonormal set, Gram-Schmidt Orthogonalisation Process, Bessel's inequality and Parsvel's identity.

Co-Curricular: Assignment, Seminar, Quiz, etc.

(15 Hrs)

Additional Inputs: Diagonalization of a matrix.

Prescribed Text Books:

J.N. Sharma & A.R.Vasista, Linear Algebra, Krishna Prakasham Mandir, Meerut.

Books for Reference:

1. III year Mathematics Linear Algebra and Vector Calculus, Telugu Academy.
2. A Text Book of B.Sc. Mathematics, Vol-III, S. Chand & Co.

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	2	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	3	2	2	3	3	1	2	3	1	2

**BLUE PRINT FOR QUESTION PAPER PATTERN
SEMESTER-IV PAPER-V**

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Vector Spaces – I	2	1	20
II	Vector Spaces – II	2	1	20
III	Linear transformations	1	1	15
IV	Matrix	1	2	25
V	Inner Product Space	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 : 3 X 10 = 30

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Total Marks = 50

P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester
Mathematics Course: REAL ANALYSIS
Paper IV (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. Prove that a non empty subset W of a vector space $V(F)$ is a subspace of V if and only if $a, b \in F, \alpha, \beta \in W \Rightarrow a\alpha + b\beta \in W$.
2. Let W be a sub space of a finite dimensional vector space $V(F)$, then prove that $\dim\left(\frac{V}{W}\right) = \dim V - \dim W$.
3. State and prove rank and nullity theorem

Part – B

4. Find the characteristic roots and the corresponding characteristic vectors of the matrix A

$$= \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$$


5. State and prove Cayley- Hamilton theorem
6. Apply the Gram-Schmidt process to the vectors $\beta_1 = (2, 1, 3)$, $\beta_2 = (1, 2, 3)$, $\beta_3 = (1, 1, 1)$ to obtain an orthonormal basis for $V_3(\mathbb{R})$ with the standard product

SECTION-B

Answer any four questions

4 X 5 M = 20 M

7. Determine whether the set of vector $\{(1, -2, 1), (2, 1, -1), (7, -4, 1)\}$ is linearly dependent or Linearly independent.
8. Let p, q, r be the fixed elements of a field F . Show that the set W of all triads (x, y, z) of elements of F such that $px + qy + rz = 0$ is a vector space of $V_3(F)$.
9. Show that the set $\{(1,0,0), (1,1,0), (1,1,1)\}$ is a basis of $C^3(C)$. Hence find the coordinates of the vector $(3+4i, 6i, 3+7i)$ in $C^3(C)$.
10. If W is a subspace of a finite dimensional vector space $V(F)$ then prove that W is also finite dimensional and $\dim W \leq \dim V$.
11. Find $T(x, y, z)$ where $T: R^3 \rightarrow R$ is defined by $T(1,1,1)=3, T(0,1,-2)=1, T(0,0,1)=-2$.
12. Find the rank of matrix is $\begin{pmatrix} 1 & 1 & 1 \\ 2 & 5 & -2 \\ 1 & 7 & -7 \end{pmatrix}$
13. State and Prove Triangle-Inequality

	P.R. Government College (Autonomous) KAKINADA	Program & Semester II B.Sc. (IV Sem)			
Course Code MAT-402P	TITLE OF THE COURSE Linear Algebra				
Teaching	Hours Allocated: 30 (Practicals)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Abstract Algebra.	-	-	2	1

Unit - I: Vector Spaces – I (12 Hrs)

Vector spaces, General properties of vector spaces, n-dimensional vectors, Addition and scalar multiplication of vectors, Internal and external composition, Null Space, Vector Subspaces, Algebra of subspaces, Linear sum of two subspaces, Linear combination of vectors, Linear span, Linear dependence and linear independence of Vectors.

Unit - II: Vector spaces – II (12 Hrs)

Basis of vector space, Finite dimensional vector space, Basis extension, Co-ordinates, Dimension of vector space, Dimension of subspace, Quotient space and Dimension of Quotient space.

Unit - III: Linear transformations (12 Hrs)

Linear transformations, Linear operators, Properties of linear transformation, Sum and product of linear transformations, Algebra of Linear Operators, Range space and Null Space of LT, Rank and Nullity of a LT, Rank & Nullity theorem.

Unit - IV: Matrix (12 Hrs)

Rank of a Matrix, Linear Equations, Characteristic Values and Characteristic Vectors of square matrix – Cayley - Hamilton Theorem.

Unit - V: Inner Product Space (12 Hrs)

Inner Product spaces, Euclidean and Unitary spaces, Norm or length of a vector, Schwartz's inequality, Triangle Inequality, Parallelogram law, Orthogonality and orthonormal set, Complete orthonormal set, Gram-Schmidt Orthogonalisation Process, Bessel's inequality and Parsvel's identity.

Prescribed Text Books:

J.N. Sharma & A.R. Vasista, Linear Algebra, Krishna Prakasham Mandir, Meerut.

Books for Reference:

1. III year Mathematics Linear Algebra and Vector Calculus, Telugu Academy.
2. A Text Book of B.Sc. Mathematics, Vol-III, S. Chand & Co.

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-V, LINEAR ALGEBRA

Unit	TOPIC	E.Q	Marks allotted to the Unit
I	Vector Spaces – I	2	12
II	Vector Spaces – II	2	12
III	Linear transformations	1	06
IV	Matrix	2	12
V	Inner Product Space	1	06
	Total	8	48

P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
Ilyear B.Sc., Degree Examinations - IV Semester
Mathematics Course-V: LINEAR ALGEBRA
(w.e.f. 2022-23 Admitted Batch)
Practical Model Paper (w.e.f. 2023-2024)

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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. Express the vector $\alpha = (1, -2, 5)$ as a linear combination of the vectors $e_1=(1, 1, 1)$, $e_2=(1, 2, 3)$ and $e_3=(2, -1, 1)$.
2. If S and T are the subsets of a vector space $V(F)$ then prove that
(i) $S \subseteq T \Rightarrow L(S) \subseteq L(T)$ and (ii) $L(S \cup T) = L(S) + L(T)$.
3. Show that the set of vectors $\{ (2,1,4), (1,-1,2), (3,1,-2) \}$ form a basis for R^3 .
4. Show that the set $\{ (1,0,0), (1,1,0), (1,1,1) \}$ is a basis of $C^3(C)$. Hence find the coordinates of the vector $(3+4i, 6i, 3+7i)$ in $C^3(C)$.

SECTION – B

5. Define linear transformation and show that the function $T: R^3 \rightarrow R^3$ defined by

$$T(x, y, z) = (x - y, 0, y + z) \text{ is a linear transformation.}$$


6. Find the characteristic roots and characteristic vectors of the matrix

$$A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}.$$

7. Verify Cayley -Hamilton theorem for the matrix $A = \begin{pmatrix} -2 & 1 & -1 \\ 1 & 2 & -1 \\ 3 & 1 & 0 \end{pmatrix}$.
8. Apply the Gram-Schmidt process to the vectors $\{ (2, 1, 3), (1, 2, 3), (1, 1, 1) \}$ to obtain an orthonormal basis for $V_3(R)$ with the standard product.

➤ **Record - 10 Marks**

➤ **Viva voce - 10 Marks**

	P.R. Government College (Autonomous) KAKINADA	Program & Semester III B.Sc. (V Sem)			
Course Code MAT-601A / 5231	TITLE OF THE COURSE 6A- Numerical Methods				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on theory of equations	6	1	-	5

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 (15h)

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 (15h)

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 (15h)

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 (15h)

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 (15h)

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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P.R. Government College (Autonomous), Kakinada
IIIyear B.Sc., Degree Examinations - V Semester
Mathematics Course: NUMERICAL METHODS
Paper VIA (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. State and prove Newton – Gregory formula for forward interpolation with equal intervals.
2. Interpolate by means of Gauss backward interpolation formula the sales for the concern for the year 1936, given that

<i>year</i>	1901	1911	1921	1931	1941	1951
<i>sales(in thousands)</i>	12	15	20	27	39	52

3. By means of Newton’s divided difference formula, find the values of $f(8), f(15)$ from the following table.

<i>x</i>	4	5	7	10	11	13
<i>f(x)</i>	48	100	294	900	1210	2028

Part – B

4. Using the following table , compute $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.2$.

<i>x</i>	1.0	1.2	1.4	1.6	1.8	2.0	2.2
<i>y</i>	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

5. Find the value of the integral Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson’s $\frac{3}{8}$ - rule $h = \frac{1}{6}$. Hence obtain an approximate value of π .

6. Given $\frac{dy}{dx} = y - x$ with $y(0) = 2$, find $y(0.1)$ and $y(0.2)$ correct to four decimal places by using Runge – Kutta method .

SECTION-B

Answer any four questions

4 X 5 M = 20 M

7. Find the missing term in the following data.

x	0	1	2	3	4
y	1	3	9	—	81

8. Compute $f(1.1)$ from the following table .

x	1	2	3	4	5
f(x)	7	12	29	64	123

9. By Lagrange’s interpolation formula , find the value of y at $x = 5$, given that

x	1	3	4	8	10
f(x)	8	15	19	32	40


10. Apply Stirling’s formula to find y_{28} given that $y_{20}=49225, y_{25} = 48316, y_{30} = 47236, y_{35} = 45926, y_{40} = 44300$.

11. Find $f^l(1.5)$ from the following table.

x	0.0	0.5	1.0	1.5	2.0
f(x)	0.3989	0.3521	0.2420	0.1245	0.0540

12. Evaluate $\int_0^1 (4x - 3x^2) dx$ taking 10 intervals byn trapezoidal rule .

13. Using Taylor’s series method, find $y(0.1)$ correct to four decimal places if $y' = x - y^2$ and $y(0) = 1$.

	P.R. Government College (Autonomous) KAKINADA	Program & Semester III B.Sc. (V Sem)			
Course Code MAT-701A / 5281	TITLE OF THE COURSE 7A - Mathematical Special Functions				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on Integration	6	1	-	5

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-	
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 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.
CO4	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.

(15h)

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 (15h)

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

(15h)

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

(15h)

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

(15h)

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

P.R. Government College (Autonomous), Kakinada
III Year B.Sc., Degree Examinations - V Semester
Mathematics Course : SPECIAL FUNCTIONS
Paper -VIA (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. Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$
2. Show that $\int_0^{\infty} (\tan x)^n dx = \frac{\pi}{2} \sec \frac{n\pi}{2}, 0 < n < 1$
3. Find the radius of convergence the exact interval of convergence of the power series $\sum \frac{(n+1)}{(n+2)(n+3)} x^n$

Part – B

4. State and Prove Rodrigues formula for $H_n(x)$.
5. Prove that $\int_{-1}^1 P_m(x) \cdot P_n(x) dx = 0$ if $m \neq n$. and $2/(2n+1)$ if $m = n$
6. Prove that $\sqrt{\frac{\pi x}{2}} J_{3/2}(x) = \frac{1}{x} \sin x - \cos x$.

SECTION-B

Answer any four questions

4 X 5 M = 20 M

7. Prove that $\Gamma(n) = \frac{1}{n} \int_0^{\infty} e^{-y^{1/n}} dy$ and hence show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$
8. Show that $\Gamma\left(\frac{1}{2} + x\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$
9. Find the radius of convergence of the series $\frac{x}{2} + \frac{1.3}{2.5} x^2 + \frac{1.3.5}{2.5.8} x^3 + \dots$
10. Show that $x = 0$ is an ordinary point of $(x^2 - 1)y'' + xy' - y = 0$, but $x = 1$ is a regular singular point.
11. Prove that $H'_n(x) = 2xH_n(x) - H_{n+1}(x)$
12. Prove that $P_3(x) = \frac{1}{2}(5x^3 - 3x)$.
14. Show that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$.

P.R. 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/NCERT

DEPARTMENT OF MATHEMATICS
SYLLABUS FOR CERTIFICATE COURSE
PAPER – VEDIC MATHEMATICS

Total Hours-30 Hours / Additional Credits: 2

Objectives of the Course:

Globally we are facing a crisis in math education. Math phobia is prevalent globally among students, teachers and even parents. There is an acute scarcity of math teacher around the world so much so that no one wants to become a math teacher anymore. So the objective is to make math fun filled and arise interest which in turn will increase the speed and accuracy in various competitive and placement exam.

Outcomes:

After the successful completion of this certificate course, the students will be able to;

- To enhance computational skills in maths.
- Develop Analytical thinking through Vedic maths.
- Develop the understanding of objectives and features of Vedic maths.
- Instil love and remove the fear of mathematics.
- Promote Vedic culture.
- Crack entrance on competitive exam.

UNIT -I

Multiplication

- i) Ekadhikenpurven method (multiplication of two numbers of two digits)
- ii) Eknuenpurven method (multiplication of two numbers of three digits)
- iii) Urdhavatriagbhyam method (multiplication of two numbers of three digits)
- iv) Nikhilam Navtascharamam dashtaha(multiplication of two numbers three digits)
- v) Combined Operations.

UNIT – II

Division

- i) Nikhilam Navtascharamam Dasthaha (two digit divisor)
- ii) Eknuenpurven method (three digits divisor)

Divisibility

- i) Ekadhikenpurven method (two digit divisor)

ii) Ekanuenpurven method (three digits divisor)

UNIT – III

LCM and HCF, Power and Root

LCM and HCF

Power (i) Square (two digit numbers) (ii) Cube (two digit numbers)

Root (i) Square root (four digit numbers) (ii) Cube root (six digit numbers)

Suggested Readings:

1. Vedic mathematics, Motilal Banarsi das, new Delhi.
2. Vedic Ganita: Vihangam Drishti – I, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic mathematics: Past, present and future, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.

BLUE PRINT FOR CERTIFICATE COURSE

PAPER – VEDIC MATHEMATICS

Unit	TOPIC	M.C.Q	Marks allotted to the Unit
I	UNIT – I	20	20
II	UNIT – II	15	05
III	UNIT - III	15	05
Total		50	50

Question Paper pattern

M.C.Q. = Multiple choice questions (1 marks)

Multiple choice questions : 50 x 1 = 50M

.....

Total Marks = 50M

.....

P.R. 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

Problem-Solving

a. Sequence and Series: Analogies of numbers and alphabet, completion of blank spaces following the pattern in a:b::c:d relationship; odd thing out missing number in a sequence or a series.

b. Data Analysis: The data given in a Table, Graph, Bar diagram, Pie Chart, Venn Diagram or Passage is to be analyzed and the questions pertaining to the data are to be answered.

c. Coding and Decoding Problems: A code pattern of English Alphabet is given. A given word or a group of letters are to be coded or decoded based on the given code or codes.

d. Date, Time Problems: Calendar problems, clock problems, blood relationships.

Unit – II : Arithmetical Ability

Numbers and divisibility, Ratio and proportion, L.C.M and G.C.D Percentages, Partnership, Profit and loss, Time, distance and work problems

Unit – III : Algebra and Geometrical Ability

Matrices, Linear equations and expressions, Binomial Theorem, Polynomials, Coordinate geometry-distance between points, Trigonometric ratios of standard angles (0° , 30° , 45° , 60° , 90° , 180°), Trigonometric identities: sample problems on heights and distances.

Unit – IV : Statistical Ability

Mean, Median, Mode, Standard Deviation, Correlation

BLUE PRINT FOR CERTIFICATE COURSE

Paper – COMPETATIVE MATHEMATICS FOR NON-MATHS STUDENTS

Unit	TOPIC	M.C.Q	Marks allotted to the Unit
I	Analytical Ability	20	20
II	Arithmetical Ability	10	10
III	Algebra and Geometrical Ability	15	15
IV	Statistical Ability	05	05
Total		50	50

Question Paper pattern

M.C.Q. = Multiple choice questions (1 marks)

Multiple choice questions : 50 x 1 = 50M

.....

Total Marks = 50M

.....

P.R. GOVERNMENT COLLEGE (A), KAKINADA

DEPARTMENT OF MATHEMATICS

VALUE ADDED COURSE – I

PAPER : LAPLACE TRANSFORMATION AND APPLICATIONS

Total Hours – 10 hours

Course Outcomes

After successful completion of this course, the student will be able to

1. understand the definition and properties of Laplace transformations
2. get an idea about first and second shifting theorems and change of scale property
3. understand Laplace transforms of standard functions like Bessel, Error function etc
4. get the knowledge of application of First Shifting, Second Shifting and Change of Scale Property theorems.

Course Content

Unit – 1

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 – 2

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 – 3

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 - Laplacetransform of Sine and Cosine integrals.

P.R. GOVERNMENT COLLEGE (A), KAKINADA

DEPARTMENT OF MATHEMATICS

VALUE ADDED COURSE – II

PAPER : MATLAB

Total Hours – 10 hours

Objectives

1. To Impart the Knowledge to the students with MATLAB software. [This enhances programming knowledge in Research and Development].
2. To provide a working introduction to the Matlab technical computing environment. [Themes of data analysis, visualization, and programming].
3. To introduce students the use of a high-level programming language, Matlab. [scientific problem solving with applications.]

Course outcomes:

By the end of this course, the student will be able to

1. Understand the basics of Matlab
2. Break a complex task up into smaller, simpler tasks
3. Case Study (Any two Modules)

About Matlab:

MATLAB or (Matrix Laboratory) is a high performance fourth generation programming language which is used for technical computing. It provides multi paradigm numerical computing environment and was developed by Math Works. It is used for integrating computation, visualization, and programming so that the programming environment becomes easy to use. The applications of MATLAB are immense. It is a powerful linear algebra tool with a very good collection of toolboxes; therefore it finds applications in research and teaching on domains of robotics and automation.

Course Content

1. Basics of Matlab and MATLAB Compiler

- The Matlab user interface
- Working with Matlab data types
- Creating matrices and arrays
- Operators and control statements
- Using scripts and functions
- Data import and export

- Using the graphical features

2. Programming with simple examples

3. Discussion of Toolboxes with Applications

- Signal Processing
- Image Acquisition Toolbox
- Image Processing
- Neural Network
- Fuzzy Logic Toolbox

Learning Resources and References:

These are some of the links and books which can help students in increasing their knowledge base and clarification of the doubts. Please visit the links and refer the books to explore the information given:

[1] <http://www.eng-tips.com/threadminder.cfm?pid=575>

[2] <http://www.matlabtutorials.com/mathforum/>

[3] <http://www.mathworks.in/matlabcentral/>

[4] <http://www.cfd-online.com/Forums/tags/matlab.html>

[5] <http://diydrones.com/forum/topic/listForTag?tag=Matlab>

DEPARTMENT OF MATHEMATICS
WORK LOAD FOR THE YEAR 2023-2024 (ODD SEMESTERS)

Name of the Subject : Mathematics

Total No. of Hours :

No. of Permanent posts sanctioned : 05

No. of Permanent staff working : Nil

No. of Contract faculty : 05

No. of Part – Time Faculty : 04

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		-	-	-	-	
2	Course - II		-	-	-	-	
3	Analytical Skills		-	-	-	-	
4	II MPC EM1	4	2	4	8	1	13
5	II MPC EM2	4	2	2	4	1	9
6	II MPE	4	2	2	4	1	9
7	II MPCs	4	2	2	4	1	9
8	II MECs	4	2	2	4	1	9
9	II MEIOT	4	2	2	4	1	9
10	II MCPC	4	2	2	4	1	9
11	II MSCs	4	2	2	4	1	9
12	II MCCs	4	2	2	4	1	9
13	II B.VOC	4	2	1	2	1	7
14	Analytical Skills						
15	III MPC EM1	12	-	-	-	2	14
16	III MPC EM2	12	-	-	-	2	14
17	III MPE	12	-	-	-	2	14
18	III MPCs	12	-	-	-	2	14
19	III MECs	12	-	-	-	2	14
20	III MCAC	12	-	-	-	2	14
21...-	III MCPC	12	-	-	-	2	14
22	III MSCs	12	-	-	-	2	14
23	III MCCs	12	-	-	-	2	14
24	III MSAS	12	-	-	-	2	14
25	III MEIOT	12	-	-	-	2	14
Total Work load for the subject Mathematics							

GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
DEPARTMENT OF MATHEMATICS
WORK LOAD FOR THE YEAR 2023-2024 (ODD SEMESTERS)

Name of the Subject : Mathematics
 Total No. of Hours : (adjusted)
 No. of Permanent posts sanctioned : 05
 No. of Permanent staff working : NIL
 No. of Contract faculty : 05
 No. of Part – Time Faculty : 04

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		-	-			
2	Course - II		-	-			
3	Analytical Skills		-	-			
4	II MPC EM1	4	2	4	8	1	13
5	II MPC EM2 ; MPE	4	2	4	8	1	13
6	II MPCs, MECs	4	2	4	8	1	13
7	II MCPC, MEIOT	4	2	2	4	1	9
8	II MSCs, MCCs	4	2	4	8	1	13
9	II BVOC	4	2	1	2	1	7
10	Analytical Skills						
11	III MPC EM1	12	-	-	-	2	14
12	III MPC EM2	12	-	-	-	2	14
13	III MPE	12	-	-	-	2	14
14	III MPCs, MECs	12	-	-	-	2	14
15	III MCAC,MCPC	12	-	-	-	2	14
16	III MSCs,MCCs	12	-	-	-	2	14
17	III MSAS,MEIOT	12	-	-	-	2	14
TOTAL							

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

DEPARTMENT OF MATHEMATICS
WORK LOAD FOR THE YEAR 2023-2024 (EVEN SEMESTERS)

Name of the Subject : Mathematics
 Total No. of Hours : (actual)
 No. of Permanent Posts sanctioned : 05
 No. of Permanent staff working : NIL
 No. of Contract faculty : 05
 No. of Part – Time Faculty : 04

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 -I						
2	MAJOR-II						
3	MINOR						
	Paper - IV						
4	II MPC EM1	4	2	4	8	1	13
5	II MPC EM2	4	2	2	4	1	9
6	II MPE	4	2	2	4	1	9
7	II MPCs	4	2	2	4	1	9
8	II MECs	4	2	2	4	1	9
9	II MEIOT	4	2	2	4	1	9
10	II MCPC	4	2	2	4	1	9
11	II MSCs	4	2	2	4	1	9
12	II MCCs	4	2	2	4	1	9
13	II B.VOC	4	2	1	2	1	7
	Paper - V						
15	II MPC EM1	4	2	4	8	1	13
16	II MPC EM2	4	2	2	4	1	9
17	II MPE	4	2	2	4	1	9
18	II MPCs	4	2	2	4	1	9
19	II MECs	4	2	2	4	1	9
20	II MEIOT	4	2	2	4	1	9
21	II MCPC	4	2	2	4	1	9
22	II MSCs	4	2	2	4	1	9
23	II MCCs	4	2	2	4	1	9
24	II B.VOC	4	2	1	2	1	7
Total Work load for the subject Mathematics							

P.R. GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

DEPARTMENT OF MATHEMATICS
WORK LOAD FOR THE YEAR 2022-2023 (EVEN SEMESTERS)

Name of the Subject : Mathematics
 Total No. of Hours : (adjusted)
 No. of Permanent Posts sanctioned : 05
 No. of Permanent staff working : NIL
 No. of Contract faculty : 05
 No. of Part – Time Faculty : 04

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 -I						
2	MAJOR-II						
3	MINOR						
	Paper - IV						
4	II MPC EM1	4	2	4	8	1	13
5	II MPC EM2	4	2	2	4	1	9
6	II MPE	4	2	2	4	1	9
7	II MPCs	4	2	2	4	1	9
8	II MECs	4	2	2	4	1	9
9	II MEIOT	4	2	2	4	1	9
10	II MCPC	4	2	2	4	1	9
11	II MSCs	4	2	2	4	1	9
12	II MCCs	4	2	2	4	1	9
13	II B.VOC	4	2	1	2	1	7
	Paper - V						
15	II MPC EM1	4	2	4	8	1	13
16	II MPC EM2	4	2	2	4	1	9
17	II MPE	4	2	2	4	1	9
18	II MPCs	4	2	2	4	1	9
19	II MECs	4	2	2	4	1	9
20	II MEIOT	4	2	2	4	1	9
21	II MCPC	4	2	2	4	1	9
22	II MSCs	4	2	2	4	1	9
23	II MCCs	4	2	2	4	1	9
24	II B.VOC	4	2	1	2	1	7
Total Work load for the subject Mathematics							

P. R. GOVERNMENT COLLEGE (A), KAKINADA

Department of Mathematics
Budget Proposal for the Academic Year 2022-23

S.No.	PURPOSE	EXPENDITURE ESTIMATED	REMARKS
1.	Guest Faculty	14400 x 4 = 10 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	
TOTAL Rs: 7,71,000			

Budget estimated in Rupees : Seven Lakhs Seventy one thousand Rupees only.



PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
KAKINADA 533 001-ANDHRA PRADESH
An AUTONOMOUS and NAAC Accredited Institution (A Grade- 3.17 CGPA)
(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. Arantha Lakshmi*

(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. As per the university syllabus in Sem V unit IV Numerical differentiation kept as it is.
- 2.
3. Solutions of Algebraic and transcendental equations topic add as additional inputs.
3. Analytical skills question paper pattern may be changed to multiple choice questions
4. Certificate course for VI semester students will be conducted in online mode.
5. Solving LDE in Laplace Transformations in value added course in third semester.

The syllabus is approved with the above suggested modification

V. Arantha Lakshmi 13/8/23
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



PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
KAKINADA 533 001-ANDHRA PRADESH
An AUTONOMOUS and NAAC Accredited Institution (A Grade- 3.17 CGPA)
(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. P. SUBHASHINI

(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. As per the university syllabus in Semester - V, Unit - V
2. numerical differentiation in retention, as it is.
3. Solution of Algebraic and transcendental equations is added as an additional input.
3. The pattern of the analytical skill paper will be changed as all are now MCQs
4. Suggested for certificate courses in either III or VI semester as in IV and V semesters syllabus is more.

The syllabus is approved with the above suggested modification

Subhashini
Signature With Date 31/8/23

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 : KANDI KATLA - CHITTIBABU
Lecturer in Mathematics, GPC, *Memadipatnam*
(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. → AS per the *UNIVERSITY* syllabus in Semester V Unit - II numerical differentiation (left as it is)
2. → Solutions of Algebraic and transcendental equations topics
3. add as additional topics
4. → In Semester - I, II Analytical skills question pattern
5. will be changed to all multiple choice question type view of Competitive exams.
→ It is suggested that certificate for VI semtr studies will be conducted in online mode (MATLAB)
→ solving L-D-E in Laplace transform in value added course in third semester

The syllabus is approved with the above suggested modification

Kandi Katla
Signature with Date *21/05/2023*

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*

