FACULTY OF SCIENCES

SYLLABUS

Master of Science (Mathematics) (FYIP)

(Semester: I -VI)

(Under Credit Based Continuous Evaluation Grading System)
(CBCEGS)

Session: 2025-26

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR

(Autonomous)

Master of Science (Mathematics) (FYIP)

Session: 2025-26

Programme Specific Outcomes

Upon successful completion of this course, students will be able to:

PSO1: Acquire a strong foundation in core areas of mathematics such as Algebra, Real and Complex Analysis, Topology, Differential Equations, and Mathematical Modelling.

PSO2: Develop the ability to think logically and critically, formulate and solve complex mathematical problems using appropriate techniques and tools.

PSO3: Apply mathematical concepts in research-oriented activities, undertake projects, and contribute to the advancement of knowledge in mathematics and allied disciplines.

PSO4: Gain hands-on experience in using computational software such as Scilab, Python, and R for solving mathematical problems and analyzing data.

PSO5: Effectively communicate mathematical ideas, theories, and results through well-structured reports, presentations, and discussions suitable for academic and professional platforms.

PSO6: Demonstrate readiness for pursuing higher studies, qualifying competitive exams, and taking up careers in academics, research, data science, actuarial sciences, and the financial sector.

PSO7: Integrate mathematical knowledge with other disciplines such as physics, computer science, economics, and engineering to solve interdisciplinary problems.

PSO8: Demonstrate awareness of ethical issues, professional responsibilities, and the societal impact of mathematical modelling and data analysis.

PSO9: Cultivate a habit of continuous learning and updating mathematical knowledge and skills in response to emerging trends and technologies.

PSO10: Develop the ability to work effectively both independently and as part of a team, taking initiative and leadership roles in collaborative mathematical projects and research work.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Five Year Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Mathematics) (FYIP)
Semester-I
Session- 2025-26

| Master of Science (Mathematics) (FYIP) Semester-I | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Type | Course Title | Hours Per Week L-T-P | Credits L-T-P | Total Credits | Max. Marks | | | | Examination Time in Hours |
| | | | | | | Total | Th | P | CA | |
| FMAL-1421/ FMAL-1031/ FMAL-1431 | C | [1]Punjabi (Compulsory)/ [2] Basic Punjabi/ [3] Punjab History and Culture | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | 3 |
| FMAL - 1102 | AEC | Communicative English-I | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | 3 |
| FMAL-1333 | DSC | Calculus | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL - 1334 | DSC | Theory of Equations | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL-1335 OR FMAM-1395 | C | [4]Dynamics OR [5]Mechanics - I | 4-0-0 3-0-2 | 4-0-0 3-0-1 | 4 4 | 100 100 | 70 40 | - 30 | 30 30 | 3 3+3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FMAP-1336 | DSC | Calculus Laboratory | 0-0-4 | 0-0-2 | 2 | 50 | - | 35 | 15 | 3 |
| FMAM-1130 | SEC | Programming Language - I | 3-0-2 | 3-0-1 | 4 | 100 | 40 | 30 | 30 | 3+3 |
| VACF-1491 | VAC | *Foundation Course | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | |
| Total | | | | | 24 | | | | | |

C-Compulsory

AEC-Ability Enhancement Course

DSC-Discipline Specific Course

SEC-Skill Enhancement Course

VAC-Value Added Course

Note:

[1]Domicle / Non Domicile of Punjab students who have studied Punjabi till 8th/ 10th class will study Punjabi (compulsory)

[2,3]The Non-Domicile of Punjab Students who have not studied Punjabi till 8th/10th class can choose either Basic Punjabi or Punjab History and Culture (PHC)

[2]Domicile of Punjab students who studied out of Punjab and did not study Punjabi till 8th / 10th class will have to study Basic Punjabi

[2]Domicile of Punjab students who have studied in Kendriya Vidyalaya of Punjab or any other school and due to any reason did not study Punjabi till 8th/10th class will have to study Basic Punjabi

[4] Only those students can opt this course who have not studied Physics, Chemistry at +2 level.

[5]Only those students can opt this course who have studied Physics, Chemistry and Mathematics at +2 level.

* Marks of this paper will not be added in total marks. Grades will be provided.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Five Year Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Mathematics) (FYIP)
Semester-II
Session- 2025-26

| Master of Science (Mathematics) (FYIP) Semester-II | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Type | Course Title | Hours Per Week L-T-P | Credits L-T-P | Total Credits | Max. Marks | | | | Examination Time in Hours |
| | | | | | | Total | TH | P | CA | |
| FMAL-2421/ FMAL-2031/ FMAL-2431 | C | [1]Punjabi (Compulsory)/ [2] Basic Punjabi/ [3] Punjab History and Culture | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | 3 |
| FMAL-2102 | AEC | Communicative English-II | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | 3 |
| FMAL -2333 | DSC | Sequences and Series | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL - 2334 | DSC | Algebra | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAM-2135 | C | Object Oriented Programming C++ | 3-0-2 | 3-0-1 | 4 | 100 | 40 | 30 | 30 | 3+3 |
| FMAP-2336 | DSC | Algebra Laboratory | 0-0-4 | 0-0-2 | 2 | 50 | - | 35 | 15 | 3 |
| FMAL-2330 | SEC | Statistical Analysis Using Spreadsheet | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | 3 |
| FMAP-2330 | SEC | Statistical Analysis Using Spreadsheet | 0-0-4 | 0-0-2 | 2 | 50 | - | 35 | 15 | 3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Laboratory | | | | | | | | |
| VACD-2161 | VAC | * Drug Abuse and Ethical Education | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | |
| Total | | | | | 26 | | | | | |

C-Compulsory

AEC-Ability Enhancement Course

DSC-Discipline Specific Course

SEC-Skill Enhancement Course

VAC-Value Added Course

Note:

[1]Domicle / Non Domicile of Punjab students who have studied Punjabi till 8th/ 10th class will study Punjabi (compulsory)

[2,3]The Non-Domicile of Punjab Students who have not studied Punjabi till 8th/10th class can choose either Basic Punjabi or Punjab History and Culture (PHC)

[2]Domicile of Punjab students who studied out of Punjab and did not study Punjabi till 8th / 10th class will have to study Basic Punjabi

[2]Domicile of Punjab students who have studied in Kendriya Vidyalaya of Punjab or any other school and due to any reason did not study Punjabi till 8th/10th class will have to study Basic Punjabi

* Marks of these papers will not be added in total marks. Grades will be provided.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Five Years Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Mathematics) (FYIP)
Semester-III
Session- 2025-26

| Master of Science (Mathematics) (FYIP) Semester-III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Type | Course Title | Hours Per Week L-T-P | Credits L-T-P | Total Credits | Max. Marks | | | | Examination Time in Hours |
| | | | | | | Total | Th | P | CA | |
| FMAL-3331 | DSC | Theory of Real Functions | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL – 3332 | DSC | Applied Differential Equations | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL-3333 | MDC | Logic and Reasoning | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAM-3334 | C | Basics of Python Programming | 3-0-2 | 3-0-1 | 4 | 100 | 40 | 30 | 30 | 3+3 |
| FMAP-3335 | DSC | Applied Differential Equations Laboratory | 0-0-4 | 0-0-2 | 2 | 50 | - | 35 | 15 | 3 |
| FMAL-3330 | SEC | Graph Theory | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| VACE-3221 | VAC | *Environmental Studies (Compulsory) | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | |
| VACG-3532 | VAC | *Gender Sensitization | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | |
| Total | | | | | 26 | | | | | |

C-Compulsory

VAC-Value Added Courses

SEC-Skill Enhancement Courses

DSC-Discipline Specific Courses

MDC-Multi Disciplinary Courses

* Marks of this paper will not be added in total marks. Grades will be provided.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Five Years Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Mathematics) (FYIP)
Semester-IV
Session- 2025-26

| Master of Science (Mathematics) (FYIP) Semester-IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Type | Course Title | Hours Per Week L-T-P | Credits L-T-P | Total Credits | Max. Marks | | | | Examination Time in Hours |
| | | | | | | Total | TH | P | CA | |
| FMAL-4331 | DSC | Number Theory | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL-4332 | DSC | Numerical Analysis | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAL-4333 | MDC | Quantitative Aptitude for Banking | 4-0-0 | 4-0-0 | 4 | 100 | 70 | - | 30 | 3 |
| FMAM-4134 | C | Statistical Computing Using R Programming | 3-0-2 | 3-0-1 | 4 | 100 | 40 | 30 | 30 | 3+3 |
| FMAP-4335 | DSC | Numerical Analysis Laboratory | 0-0-4 | 0-0-2 | 2 | 50 | - | 35 | 15 | 3 |
| FMAM-4330 | SEC | Statistical Methods | 3-0-2 | 3-0-1 | 4 | 100 | 40 | 30 | 30 | 3+3 |
| VACM-4502 | VAC | *Moral Education | 2-0-0 | 2-0-0 | 2 | 50 | 35 | - | 15 | |
| Total | | | | | 24 | | | | | |

C-Compulsory

VAC-Value Added Courses

SEC-Skill Enhancement Courses

DSC-Discipline Specific Courses

MDC-Multi Disciplinary Courses

* Marks of these papers will not be added in total marks. Grades will be provided

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Five Years Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Mathematics) (FYIP)
Semester-V
Session- 2025-26

| Master of Science (Mathematics) (FYIP) Semester-V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Type | Course Title | Hours Per Week L-T-P | Credits L-T-P | Total Credits | Marks | | | | Examination Time in Hours |
| | | | | | | Total | TH | P | CA | |
| FMAL-5331 | C | Number Theory | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-5332 | C | Discrete Mathematics | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-5333 | C | Linear Integral Equations | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-5334 | C | Riemann Integration | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-5335 | C | Metric Spaces | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| SECJ-5551 | AC | *Job Readiness Course | 2-0-0 | 2-0-0 | 2 | 50 | 40 | - | 10 | |
| Total | | | | | 22 | 500 | | | | |

Note:

*Credits/Grade points of these courses will not be included in SGPA/CGPA of Semester/Programme. Only grades will be provided. .

C- Compulsory

AC- Audit Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Five Years Integrated Programme

(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Master of Science (Mathematics) (FYIP)

Semester-VI

Session- 2025-26

| Master of Science (Mathematics) (FYIP) Semester-VI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Type | Course Title | Hours Per Week L-T-P | Credits L-T-P | Total Credits | Marks | | | | Examination Time in Hours |
| | | | | | | Total | TH | P | CA | |
| FMAL-6331 | C | Complex Analysis | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-6332 | C | Analytical Skills | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-6333 | C | Numerical Analysis | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-6334 | C | Special Functions | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| FMAL-6335 | C | Differential Geometry | 3-1-0 | 3-1-0 | 4 | 100 | 80 | - | 20 | 3 |
| Total | | | | | 20 | 500 | | | | |

Note:

C- Compulsory

AC-Audit Course

Master of Science (Mathematics)(FYIP)
Semester–I

Session- 2025-26
Course Title: Basic Punjabi
Course Code: FMAL-1031
Course Outcomes

CO1:ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਪੜ੍ਹਾਉਣ ਦਾ ਮਨੋਰਥ ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਨੂੰ ਸਿਖਾਉਣ ਦੀ ਪ੍ਰਕਿਰਿਆ ਵਿਚ ਪਾ ਕੇ ਇਕ ਹੋਰ ਭਾਸ਼ਾ ਸਿੱਖਣ ਦਾ ਮੌਕਾ ਪ੍ਰਦਾਨਕਰਨਾ ਹੈ।ਵਿਦਿਆਰਥੀਆਂ ਨੂੰਪੈਂਤੀਅੱਖਰੀ, ਅੱਖਰਕ੍ਰਮ, ਪੈਰਬਿੰਦੀਵਾਲੇ ਵਰਣ ਅਤੇ ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ ਅਤੇ ਮਾਤਰਾਵਾਂ (ਮੁੱਢਲੀਜਾਣਪਛਾਣ) ਲਗਾਖ਼ਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) ਦੀ ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ ਤੋਂਜਾਣੂ ਕਰਵਾਇਆਜਾਵੇਗਾ।

CO2:ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀਸ਼ਬਦਬਣਤਰ ਦੀ ਮੁੱਢਲੀਜਾਣਪਛਾਣ (ਸਾਧਾਰਨਸ਼ਬਦ, ਸੰਯੁਕਤ ਸ਼ਬਦ, ਮਿਸ਼ਰਤ ਸ਼ਬਦ,ਮੂਲ ਸ਼ਬਦ,ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ) ਤੋਂਜਾਣੂ ਕਰਵਾਇਆਜਾਵੇਗਾ।

CO3:ਵਿਦਿਆਰਥੀਆਂ ਨੂੰਨਿੱਤਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀਸ਼ਬਦਾਵਲੀ : ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇਨਾਤੇ, ਖੇਤੀ ਅਤੇ ਹੋਰਧੰਦਿਆਂਆਦਿ ਨਾਲ ਸੰਬੰਧਤ ਤੋਂਜਾਣੂ ਕਰਵਾਇਆਜਾਵੇਗਾ।

CO4:ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀਵਿਚਹਫ਼ਤੇ ਦੇ ਸੱਤਦਿਨਾਂ ਦੇ ਨਾਂ, ਬਾਰ੍ਹਾਂਮਹੀਨਿਆਂ ਦੇ ਨਾਂ, ਰੁੱਤਾਂ ਦੇ ਨਾਂ, ਇਕਤੋਂ ਸੌ ਤੱਕਗਿਣਤੀਸ਼ਬਦਾਂਵਿਚਸਿਖਾਉਣਾ ਹੈ।

Master of Science (Mathematics) FYIP)

Semester–I

Session- 2025-26
Course Title: Basic Punjabi
Course Code: FMAL-1031

**ਸਮਾਂ : 3 ਘੰਟੇ** Maximum Marks: 50

L-T-P Theory : 35

2-0-0 CA : 15

**ਅੰਕ ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ**

1. **ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਸੈਕਸ਼ਨ ਹੋਣਗੇ।ਸੈਕਸ਼ਨ ਂਣ ਤੱਕ ਦੇ ਪ੍ਰਸ਼ਨ ਯੂਨਿਟ ਜ਼ਜ਼ੜ ਵਿਚੋਂ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।**

2. **ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।**

3. **ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ 7 ਅੰਕ ਹਨ।**

4. **ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ ਪ੍ਰਸ਼ਨਾਂ**

**ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।**

## ਪਾਠਕ੍ਰਮ

### Unit-I

**ਪੈਂਤੀਅੱਖਰੀ, ਅੱਖਰਕ੍ਰਮ, ਪੈਰਬਿੰਦੀਵਾਲੇ ਵਰਣ ਅਤੇ ਪੈਰਵਿਚਪੈਣਵਾਲੇ ਵਰਣ ਅਤੇ ਮਾਤ੍ਰਵਾਂ (ਮੁੱਢਲੀ ਜਾਣਪਛਾਣ) ਲਗਾਖ਼ਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ ।**

### Unit-II

**ਪੰਜਾਬੀਸ਼ਬਦਬਣਤਰ : ਮੁੱਢਲੀਜਾਣਪਛਾਣ (ਸਾਧਾਰਨਸ਼ਬਦ, ਸੰਯੁਕਤਸ਼ਬਦ, ਮਿਸ਼ਰਤਸ਼ਬਦ, ਮੂਲ ਸ਼ਬਦ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ)**

### Unit -III

**ਨਿੱਤਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀਸ਼ਬਦਾਵਲੀ : ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇਨਾਤੇ, ਖੇਤੀ ਅਤੇ ਹੋਰਧੰਦਿਆਂਆਦਿਨਾਲ ਸੰਬੰਧਤ।**

### Unit -IV

**ਹਫ਼ਤੇ ਦੇ ਸੱਤਦਿਨਾਂ ਦੇ ਨਾਂ, ਬਾਰ੍ਹਾਂਮਹੀਨਿਆਂ ਦੇ ਨਾਂ, ਰੁੱਤਾਂ ਦੇ ਨਾਂ, ਇਕਤੋਂ ਸੌ ਤਕ ਗਿਣਤੀਸ਼ਬਦਾਂਵਿਚ .**

Master of Science (Mathematics)(FYIP)

Semester–I

Session- 2025-26
Course Title: Punjabi Compulsory

Course Code: FMAL-1421
Course Outcomes

CO1: ‘ਸਾਹਿਤ ਦੇ ਰੰਗ’ ਪੁਸਤਕ ਦੇ ਕਵਿਤਾਭਾਗਨੂੰ ਪੜ੍ਹਾਉਣ ਦਾਮਨੋਰਥਵਿਦਿਆਰਥੀਆਂਅੰਦਰਕਵਿਤਾਪ੍ਰਤੀਦਿਲਚਸਪੀ, ਸੂਝ ਨੂੰ ਪੈਦਾਕਰਨਾ ਹੈ ਤਾਂਕਿ ਉਹ ਆਧੁਨਿਕਦੌਰਵਿਚਚਲਰਹੀਆਂਕਾਵਿਧਾਰਾਵਾਂ ਅਤੇ ਕਵੀਆਂਬਾਰੇ ਗਿਆਨਹਾਸਲਕਰ ਸਕਣ।ਇਸ ਦਾਹੋਰਮਨੋਰਥਕਵਿਤਾ ਦੀ ਵਿਆਖਿਆ, ਵਿਸ਼ਲੇਸ਼ਣ ਤੇ ਮੁਲੰਕਣ ਦੀ ਪ੍ਰਕਿਰਿਆਤੋਂਜਾਣੂ ਕਰਾਉਣਾਵੀ ਹੈ ਤਾਂਕਿ ਉਹ ਸਮਕਾਲੀ ਸਮਾਜਦੀਆਂ ਸਮੱਸਿਆਵਾਂਨੂੰ ਸਮਝ ਸਕਣ ਅਤੇ ਆਲੋਚਨਾਤਮਕਦ੍ਰਿਸ਼ਟੀਬਣਾ ਸਕਣ।

CO2:ਯਸਾਹਿਤ ਦੇ ਰੰਗ’ ਪੁਸਤਕ ਦੇ ਕਹਾਣੀਭਾਗ ਨੂੰ ਸਿਲੇਬਸ ਵਿਚਸ਼ਾਮਿਲਕਰ ਕੇ ਵਿਦਿਆਰਥੀਆਂਅੰਦਰਕਹਾਣੀਪੜ੍ਹਣ ਦੀ ਰੁਚੀ ਨੂੰ ਪੈਦਾਕਰਨਾ ਹੈ ਅਤੇ ਕਹਾਣੀਜਗਤਨਾਲਜੋੜਣਾ ਹੈ।

CO3:ਯਪੈਰ੍ਹਾ ਰਚਨਾ ਅਤੇ ਪੈਰ੍ਹਾਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉਤਰ ਦੇਣ ਦਾਮਨਰੋਥਵਿਦਿਆਰਥੀਆਂ ਦੀ ਬੁੱਧੀ ਨੂੰ ਤੀਖਣਕਰਦਿਆਂ ਉਨਾਂ ਦੀ ਲਿਖਣਪ੍ਰਤਿਭਾ ਨੂੰ ਉਜਾਗਰਕਰਨਾ ਹੈ।

CO4 : ਧੁਨੀਵਿਉਂਤ ਪੜ੍ਹਣਨਾਲਵਿਦਿਆਰਥੀ ਧੁਨੀਆਂ ਦੀ ਉਚਾਰਨਪ੍ਰਣਾਲੀਤੋਂਵਾਕਫ਼ ਹੋਣਗੇ।

Master of Science (Mathematics)(FYIP)
Semester–I
Session- 2025-26
Course Title: Punjabi Compulsory
Course Code: FMAL-1421

**ਸਮਾਂ : 3 ਘੰਟੇ** Maximum Marks: 50

Theory : 35

L-T-P 2-0-0 CA :15

**ਅੰਕ ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ**

1. **ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਸੈਕਸ਼ਨ ਹੋਣਗੇ।ਸੈਕਸ਼ਨ੍ਂਣਤੱਕ ਦੇ ਪ੍ਰਸ਼ਨ ਯੂਨਿਟਜ਼੍ਜ਼ੜ ਵਿਚੋਂ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।**

2. **ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।**

3. **ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ 7 ਅੰਕ ਹਨ।**

4. **ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ ਪ੍ਰਸ਼ਨਾਂਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।**

## ਪਾਠਕ੍ਰਮ ਅਤੇ ਪਾਠ ਪੁਸਤਕਾਂ

Unit-I

**ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪਾ.ਡਾਮਹਿਲਸਿੰਘ),ਭਾਗਪਹਿਲਾ(ਕਵਿਤਾ ),ਰਵੀ ਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨ,ਅੰਮ੍ਰਿਤਸਰ।** (ਪ੍ਰਸੰਗ ਸਹਿਤ ਵਿਆਖਿਆ,**ਸਾਰ**) **(ਡਾ.ਹਰਿਭਜਨਸਿੰਘ,ਪਾਸ਼,ਸੁਰਜੀਤਪਾਤਰ ਕਵੀ ਪਾਠਕ੍ਰਮਦਾਹਿੱਸਾਨਹੀਂਹਨ) 8ਅੰਕ**

Unit -II

**ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪਾ.ਡਾਮਹਿਲਸਿੰਘ),ਭਾਗਪਹਿਲਾ(ਕਹਾਣੀ),**
**ਰਵੀ ਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨ,ਅੰਮ੍ਰਿਤਸਰ।**
**(ਸਾਰ,ਵਿਸ਼ਾਵਸਤੂ)**
**(ਕੋਈਇਕ ਸਵਾਰ,ਘੋਟਣਾ, ਆਪਣਾਆਪਣਾਹਿੱਸਾਕਹਾਣੀਆਂਪਾਠਕ੍ਰਮਦਾਹਿੱਸਾਨਹੀਂਹਨ) 8 ਅੰਕ**

Unit -III

**ਪੈਰ੍ਹਾਰਚਨਾ**

**ਪੈਰ੍ਹਾਪੜ੍ਹ ਕੇ ਪਸ਼੍ਨਾਂ ਦੇ ਉਤਰ। 8 ਅੰਕ**

Unit -IV

**(ੳ) ਪੰਜਾਬੀ ਧੁਨੀਵਿਉਂਤ :ਪਰਿਭਾਸ਼ਾ ਤੇਉਚਾਰਨਅੰਗ**

**(ਅ) ਸਵਰ, ਵਿਅੰਜਨ 8 ਅੰਕ**

Master of Science (Mathematics)(FYIP)
Semester–I

Session- 2025-26
Course Title: Punjab History and Culture (From Earliest Times to C 320)
Course Code: FMAL-1431

COURSE OUTCOMES

After completing Semester I and course on Punjab History and Culture students of History will be able to identify and have a complete grasp on the sources & writings of Ancient Indian History of Punjab.

CO1: Identify and understand the sources and physical features of Punjab

CO 2: To study the earliest civilisation (Indus Valley Civilization) and original home of Aryans

CO 3: To examine the Social, Religious and Economic life during Early and Later Vedic Age

CO 4: To comprehend the Buddhist, Jain and Hindu faith and their relevance in the modern times

Master of Science (Mathematics)(FYIP)

Semester–I

Session- 2025-26
Course Title: Punjab History and Culture (From Earliest Times to C 320)
Course Code: FMAL-1431

Examination Time: 3 Hours | Max. Marks: 50
Credits L-T-P: 2-0-0 | Theory: 35
Contact Hours: 2 Hrs/Week | CA: 15

Instructions for the Paper Setter:

1. Question paper shall consist of four Units
2. Examiner shall set 8 questions in all by selecting Two Questions of equal marks from each Unit.
3. Candidates shall attempt 5 questions in 500 words, by at least selecting One Question from each Unit and the 5th question may be attempted from any of the four Units.
4. Each question will carry 7 marks

Unit I

1. Physical features of the Punjab
2. Sources of the ancient history of Punjab

Unit II

3. Harappan Civilization: social, economic and religious life of the Indus Valley People.
4. The Indo-Aryans: Original home

Unit III

5. Social, Religious and Economic life during Early Vedic Age.
6. Social, Religious and Economic life during Later Vedic Age.

Unit IV

7. Teachings of Buddhism
8. Teachings of Jainism

Suggested Readings


- B.N. Sharma, Life in Northern India, Delhi. 1966.
- Budha Parkash, Glimpses of Ancient Punjab, Patiala, 1983.
- Chopra, P.N., Puri, B.N., & Das,M.N.(1974). A Social, Cultural & Economic History of India, Vol. I, New Delhi: Macmillan India.
- L. M Joshi (ed.), History and Culture of the Punjab, Art-I, Patiala, 1989 (3rd edition)
- L.M. Joshi and Fauja Singh (ed.), History of Punjab, Vol.I, Patiala 1977.

Master of Science (Mathematics)(FYIP)

Semester–I

Session- 2025-26
Course Title: Communicative English-I
Course Code: FMAL-1102
Course Outcomes

The students will be:

CO 1: able to enhance their vocabulary through vocabulary building exercises

CO2: able to improve their writing skills by writing letters and reports

CO3: able to enhance their reading and analyzing power of texts through guided reading by the study of "Making Connections" by Kenneth J. Pakenham

CO4: acquainted to the techniques of effective essay writing

Master of Science (Mathematics)(FYIP)

Semester–I
Session- 2025-26
Course Title: Communicative English-I
Course Code: FMAL-1102

Examination Time: 3 Hours | Max. Marks: 50
Theory: 35
L T P | CA:15
2 0 0

Instructions for Paper Setters:

Eight questions of equal marks (07 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four).Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

"Word List", "Correct Usage of Commonly used words and Phrases" from the chapter "Vocabulary" given in The Written Word by Vandana R. Singh

Unit II

Letter- writing as prescribed in The Written Word by Vandana R. Singh
Report writing as prescribed in The Written Word by Vandana R. Singh

Unit III

Unit-I from Making Connections: A Strategic Approach to Academic Reading by Kenneth J. Pakenham, Second Edition

Unit IV

Unit-II from Making Connections: A Strategic Approach to Academic Reading by Kenneth J. Pakenham, Second Edition

Text Books:

The Written Word by Vandana R. Singh, Oxford University Press, New Delhi.
Making Connections: A Strategic Approach to Academic Reading by Kenneth J.Pakenham, Second Edition

Master of Science (Mathematics)(FYIP)

Semester–I
Session- 2025-26
Course Title: Calculus
Course Code: FMAL-1333

## Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand real number system, limit of a function, basic properties of limit, continuity, and classification of discontinuities & to apply it in real world problem.

CO 2: To Classify the difference between increasing and decreasing functions and understand the concept of Differentiability of functions and maxima & minima.

CO 3: Demonstrate Asymptotes, points of inflexion, multiple points on a curve & also to differentiate between concavity and convexity.

CO 4: To understand the concepts of Riemann sum, definite integrals and their properties, the fundamental theorem of calculus, applications to length of arc and area bounded between curves, Reduction Formulae & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

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Master of Science (Mathematics)(FYIP)

Semester–I
Session-2025-26
Course Title: Calculus
Course Code: FMAL-1333

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
L T P | CA:30
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four).Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Review of limit and continuity of a function of real variable, indeterminate forms, higher order derivatives, Leibnitz theorem and applications to problems of the type

$$e^{ax}\sin(bx+c)\,,\ e^{ax}\cos(bx+c)\,,\ (a+bx)^n\sin x,\ (a+bx)^n\cos x.$$

## Unit II

Differentiability of functions of real variable, increasing and decreasing functions, maxima and minima, Taylor's and Maclaurin's theorem with various forms of remainders.

## Unit III

Concave upward, Concave downward, Point of inflexion, Asymptotes, Horizontal and Vertical Asymptotes, asymptotes of the algebraic curves represented by homogeneous equation in two variables.

## Unit IV

Anti derivative of function of real variable, Riemann sums, definite integrals and their properties, the fundamental theorem of calculus, applications to length of arc and area bounded between Cartesian curves, Reduction Formulae, illustration of Reduction Formulae of type $\int \mathrm{Sin}^n x\,dx$, $\int \cos^n x\,dx$, $\int \tan^n x\,dx$, $\int \mathrm{Sec}^n x\,dx$, $\int \mathrm{Sin}^n x \mathrm{Sin}^m x\,dx$

Text Book:
Thomas, G.B., and Finney, L.R., Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998, (Scope as in Ch.1-7, 9, 11).

Reference Books:


1. Apostol, T.M., Calculus, An Indian Adaptation, Wiley, 2022.
2. Anton, H., Bivens, I., and Davis, S., Calculus, 12th Ed. John Wiley and Sons (Asia)P. Ltd, Singa- pore, 2002. (Scope as in ch.0-3, 6, 10,12)
3. R. Courant and F. John. Introduction to Calculus and Analysis (Vol. 1), Springer, 1999. (Scope as in Ch.4)

Master of Science (Mathematics) (FYIP)

Semester–I
Session-2025-26
Course Title: Theory of Equations
Course Code: FMAL- 1334
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of Greatest Common Divisor, Unique Factorization of Polynomial over a field F

CO 2: To find the relations between the roots and coefficients of general equation in one variable, distinguish between solution of cubic equations and Bi-quadratic equations.

CO 3: Classify Symmetric functions, Solutions of reciprocal and binomial equations, and Algebraic solutions of the cubic and biquadratic Equations using Cardan's Method, Descarte's Method, Ferrari Method.

CO 4: Obtain homogeneous products, limits of the roots of equations and Separation of the roots of equations.

Master of Science (Mathematics) (FYIP)

Semester: I
Session: 2025-26
Course Title: Theory of Equations
Course Code: FMAL- 1334

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
L T P | CA: 30
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, Euclid's Algorithm, Greatest Common Divisor, Unique Factorization of Polynomial over a field F of numbers (Statement Only), Fundamental Theorem of Algebra (Statement only), Roots and their Multiplicity.

Unit II

General properties of equations, Relationship between the roots and the coefficients, Fundamental theorem of symmetric polynomials (without proof), Evaluation of symmetric functions of roots, Rational roots of polynomials with integral coefficients, Descarte's rule of signs positive and negative rule.

Unit III

Symmetric functions, Applications of symmetric function of the roots, Transformation of equations, Solutions of reciprocal and binomial equations, Algebraic solutions of the cubic and biquadratic Equations using Cardan's Method, Descarte's Method, Ferrari Method.

Unit IV

Symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations, Separation of the roots of equations

Text Books:

1. Burnside, W.S. and Panton, A.W., The Theory of Equations, Dublin University Press, 1954.
2. MacDuffee, C.C., Theory of Equations, John Wiley & Sons Inc., 1954.

Reference Book:

Kishan, H., Theory of Equations, Atlantic Publications, 2022.

Master of Science (Mathematics)(FYIP)

Semester–I
Session-2025-26
Course Title: Dynamics
Course Code: FMAL -1335

## Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate the basic relations between distance, time, velocity and acceleration, manage to solve the problems of Newton's Laws of Motion and the motion of particles connected by a string.

CO 2: Illustrate motion along a smooth inclined plane. Solve different types of problems with Variable Acceleration. Discuss Simple Harmonic Motion.

CO 3: Understand the concept of projectile, oscillating system.

CO 4: Define Work, Power and Energy and explain their relationship. Use measurement tools to apply the concepts of Work and power to solve real life problems. Identify the different types of energy.

Master of Science (Mathematics)(FYIP)

Semester–I

Session-2025-26

Course Title: Dynamics

Course Code: FMAL -1335

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 70

4 0 0 | CA: 30

Instructions for the Paper Setter: Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

## Unit-I

Rectilinear motion in a straight line with uniform acceleration, Newton's laws of motion.

Motion of two particles connected by a string.

## Unit-II

Motion along a smooth inclined plane. Variable acceleration. Simple Harmonic Motion.

## Unit-III

Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles.

Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum.

## Unit-IV

Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.

Text Book:

R. Kumar, Fundamentals of Dynamics, Pardeep Publications, Jalandhar city, second edition, 2004

Reference Books:

1.F. Chorlton, Text Book of Dynamics, CBS Publishers, New Delhi, second edition, 2004 (Scope in chapters 3,8).

2. S.R. Gupta, Elementary Analytical Dynamics, Sultan Chand and Company, New Delhi, Fourteen Edition, 1983(Scope in chapters 1,2,3)

Master of Science (Mathematics)(FYIP)

Semester–I
Session-2025-26
Course Title: Mechanics - I
Course Code: FMAM-1395

## COURSE OUTCOMES:

After passing this course, students will be able to:

CO1: Understand the various coordinate systems and their applications. Students will learn the applications of Newton's laws of motion in various situations such as variable mass systems.

CO2:They will understand the elastic scattering in lab and centre of mass systems. They will learn the rotational motion of a body in general by studying Euler's equations and the Moment of inertia tensor.

CO3: Know the fundamental forces of nature, the concept of centre mass, central forces and the motion of particles under central force and to determine the turning points of orbit.They will be able to understand planetary motion by solving differential equations of orbits and studying Kepler's laws.

CO4: They will learn Galilean transformations and understand the origin of fictitious forces in non-inertial frames. They will understand the consequences fictitious forces on acceleration due to gravity, motion of a particle on earth, and Foucault's pendulum.

Master of Science (Mathematics) (FYIP)

Semester–I
Session-2025-26
Course Title: Mechanics - I
Course Code: FMAM-1395

Examination Time: (3+3) Hours

Max. Marks: 100
Practical:30
Theory: 40
CA: 30

L T P
3 0 1

Instructions for Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Reference frames, Inertial frames,Displacement, velocity& acceleration in Cartesian, Plane polar, and Sphericalpolar coordinate systems,Area and volume in these coordinate systems. solidangle.Review of Newton's Laws of Motion, Momentum of variable-mass system: motion of the rocket.

## Unit II

Elastic and inelastic collisions in laboratory and centre ofmass systems; velocities, angles, energies in these systems and their relationships. Rotational motion of the rigid body, Torques due to internalforces, angular momentum about the centre of mass, Principal axes and inertia tensor, Kinetic energy of rotation, Euler's equations,

## Unit III

Forces in nature (Qualitative). Conservative forces. Central Forces.Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Reduced mass, Equation of motion of a reduced mass under central force and energy. Differential equation of the orbit, Equation of orbit under inverse square force field, turning points, Kepler's Laws.

## Unit IV

Galilean transformations; Galilean invariance of space &time intervals, Newton's laws of motion and conservation laws. Non-inertial frames, Fictitious forces. Effect of rotation of the earth on'g'. Effects of centrifugal and Coriolis forces produced as a result of earth's rotation. Foucault's pendulumandits equationofmotion.

Books Recommended:


1. Knight,W.D.,Ruderman,M.A.,Helmholtz,C.A.andMoyer,R.J.,BerkeleyPhysicsCourse,Vol.I Mechanics
2. Halliday, D., Resnick, R., and Walker, J., Fundamentals of Physics, 6Edition, Wiley India Pvt.Ltd,NewDelhi, 2004.
3. Gupta,S.K.,Analytical Mechanics,ModernPublishers.AnIntroductiontoMechanics,DanielKleppner &Robert Kolenkow, TataMcGrawHillPublishingCompanyLtd., NewDelhi.
4. Feynman, R.P., Leighton, R. and Sands, M., The Feynman Lectures in Physics, The New MillenniumEdition,Basic Books, Vol.I, Mechanics,

Master of Science (Mathematics) (FYIP)

Semester–I
Session-2025-26
Course Title: Mechanics – I (Practical)
Course Code: FMAM-1395

COURSE OUTCOMES:

After passing this course, students will be able to:

CO1: to conduct a specific experiment from a given list, applying theoretical knowledge and practical skills to accurately complete the procedure and obtain reliable results.

CO2: to articulate the theoretical background and principles underlying the chosen experiment.

CO3: demonstrate their understanding of the experiment through oral questioning and discussion.

CO4: well-organized and accurate practical file documenting all experiments conducted.

Master of Science (Mathematics) (FYIP)

Semester–I
Session-2025-26
Course Title: Mechanics – I (Practical)
Course Code: FMAM-1395

Credits: 0-0-1 Max Marks: 30

Examination Time: 3 Hours Pass Mark: 11

Instructions to Practical Examiner

Question paper is to be set on the spot jointly by the external and internal examiners. Two copies of the same to be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar

General Guidelines for Practical Examination

The distribution of marks is as follows :

i) One experiment 10 Marks

ii) Brief Theory 7 Marks

iii) Viva–Voce 7 Marks

iv) Record (Practical file) 6 Marks

II. There will be one session of 2 hours duration. The paper will have one session. Paper will consist of 5 experiments, out of which an examinee will mark 4 experiments and one of these is to be allotted by the external examiner.

III. The number of candidates in a group for practical examination should not exceed 12.

IV. In a single group, no experiment should be allotted to more than three examinees.

**LIST OF EXPERIMENTS**

1. To determine the value of acceleration duetogravityataplacewithKater'spendulum.
2. To Find The Moment of Inertia of a flywheel.
3. To find the moment of inertia of an irregular body about an axis through its center of gravity with torsion pendulum.
4. To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass)
5. Study of bending of beams and determination of Young’s modulus.
6. Determination of Poisson’s ratio for rubber.

Master of Science (Mathematics)(FYIP)

Semester–I
Session-2025-26
Course Title: Calculus Laboratory
Course Code: FMAP-1336
Course Outcomes

CO1: To Plot and analyze elementary function graphs and understand the effects of parameters $a$ and $b$.

CO2: To Sketch and interpret polynomial functions of degree 4 and 5.

CO3:To Generate surfaces of revolution and sketch standard 3D quadric surfaces using Cartesian coordinates.

CO4: To Perform matrix operations and compute eigenvalues and eigenvectors.

Master of Science (Mathematics)(FYIP)

Semester–I

Session-2025-26

Course Title: Calculus Laboratory

Course Code: FMAP-1336

Examination Time: 3 Hours | Max. Marks: 50

Practical: 35

L T P | CA:15

0 0 2

Practical (Using any Software)

1. Plotting the graphs of elementary functions: $e^{ax+b}$ $\sin(bx + c)$, $\log(ax + b)$, 1/(ax+b), $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of the polynomial of degree 4 and 5
3. Obtaining surfaces of revolution of curves and their area.
4. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, hyperbolic paraboloid using Cartesian coordinates.
5. Matrix operations (addition, multiplication, inverse, transpose), eigenvalues and eigenvectors.

Text Book:


1. Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998. (Scope as in Ch.1-7,9,11)


Reference Books:


1. Anton, H., Bivens, I., and Davis, S., Calculus, 12th Ed. John Wiley and Sons (Asia) P. Ltd, Singapore, 2002. (Scope as in Ch.0-3,6,10,12)
2. Courant, R.and John, F., Introduction to Calculus and Analysis (Vol I), Springer,1999.(Scopes in Ch.4)

Master of Science (Mathematics)(FYIP)

Semester–I
Session-2025-26
Course Title: Programming Language - I
Course Code: FMAM- 1130
Course Outcomes

After passing course the student will be able to:

CO1: Articulate various kind of software and hardware used in computers.

CO2: Work with different set of operations in C programming.

CO3: Apply various control statements of C Programming Language for designing solutions to different real world problems.

CO4: Implement single and multidimensional arrays for representing complex data collections.

Master of Science (Mathematics)(FYIP)

Semester–I
Session-2025-26
Course Title: Programming Language - I
Course Code: FMAM- 1130

Examination Time: (3+3) Hours | Max. Marks: 100
Practical-30
Theory: 40
CA: 30

L T P
3 0 1

Instructions for the Paper Setters: Eight questions of equal marks (8 Marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Unit I

Introduction to Computer Programming, Program Development life cycle, algorithms, flow chart, decision table & pseudo code.

Unit II

Introduction to C language, data types, Operators and Expression, Input/output Functions, Structured programming elements, Control statements: Branching, Jumping, Looping Arrays.

Unit III

Pointers, Functions: Inbuilt Functions, User defined Functions, Recursion, Storage Classes in C, dynamic memory management.

Unit IV

Strings, Structure and union, Reference variables, basics of searching and sorting techniques, file handling in C

References / Textbooks:


1. E. Balagurusamy, Programming in ANSI C, Tata McGraw-Hill (2002), 5th edition.
2. Stephen G. Kochan, Programming in C, Pearson Education (2015), 4th edition.
3. R.S. Salari, Application Programming in C, Khanna Book Publishing (2012), 4thedition.
4. Anshuman Sharma, Learn programming in C, Lakhanpal Publishers (2016), 7thedition.

Practicals

Development of Computer Programs using C language for:

- Separation of odd and even numbers
- Summation of N Natural numbers
- Generating Fibonacci series
- Roots of quadratic and Cubic equations
- Evaluating various mathematical functions: exp(x), log(x), sin(x), cos(x) etc using Taylor series expansion
- Arranging numbers in ascending and descending orders
- Finding maximum/minimum of numbers, for matrix operations, determinants, and inverse of 3x3 matrix, elementary numerical methods and statistical methods.

# SEMESTER-II

Master of Science (Mathematics)(FYIP)

Semester–II
Session- 2025-26
Course Title: Basic Punjabi
Course Code: FMAL-2031
Course Outcomes

CO1: ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ (ਨਾਂਵ, ਪੜਨਾਂਵ, ਕਿਰਿਆ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸਬੰਧਕ, ਯੋਜਕ ਅਤੇ ਵਿਸਮਿਕ)ਨੂੰ ਪੜ੍ਹਾਉਣ ਦਾ ਮਨੋਰਥ ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਅਮੀਰੀ ਦਾ ਅਤੇ ਬਾਰੀਕੀਆਂ ਨੂੰ ਸਮਝਣ ਲਈ ਵੱਖਰੇ ਵੱਖਰੇ ਸਿਧਾਂਤਾਂ ਦਾ ਵਿਕਾਸ ਕਰਨਾ ਹੈ।

CO2: ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ (ਸਾਧਾਰਨ ਵਾਕ, ਸੰਯੁਕਤ ਵਾਕ, ਮਿਸ਼ਰਤ ਵਾਕ, ਬਿਆਨੀਆ ਵਾਕ, ਪ੍ਰਸ਼ਨ ਵਾਚਕ ਵਾਕ ਅਤੇ ਹੁਕਮੀ ਵਾਕ) ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਇਸ ਦੀ ਬਣਤਰ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ ਅਤੇ ਉਨ੍ਹਾਂ ਦੀ ਭਾਸ਼ਾ ਤੇ ਪਕੜ ਮਜਬੂਤ ਹੋਵੇਗੀ।

CO3: ਪੈਰ੍ਹਾ ਰਚਨਾ ਅਤੇ ਸੰਖੇਪ ਰਚਨਾ ਦਾ ਮਨੋਰਥ ਵਿਦਿਆਰਥੀਆਂ ਦੀ ਬੁੱਧੀ ਨੂੰ ਤੀਖਣ ਕਰਦਿਆਂ ਉਨਾਂ ਦੀ ਲਿਖਣ ਪ੍ਰਤਿਭਾ ਨੂੰ ਉਜਾਗਰ ਕਰਨਾ ਹੈ।

CO4: ਘਰੇਲੂ ਅਤੇ ਦਫ਼ਤਰੀ ਚਿੱਠੀ ਪੱਤਰ ਲਿਖਣ ਦਾ ਮਨੋਰਥ ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਇਸ ਕਲਾ ਵਿਚ ਨਿਪੁੰਨ ਕਰਨਾ ਹੈ ਜ਼ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ ਦੀ ਵਰਤੋਂ ਨਾਲ ਗੱਲਬਾਤ ਵਿਚ ਪਰਪੱਕਤਾ ਆਉਂਦੀ ਹੈ।ਇਹ ਵਿਦਿਆਰਥੀਆਂ ਦੀ ਗੱਲਬਾਤ ਵਿਚ ਨਿਖਾਰ ਲਿਆਉਣ ਦਾ ਕੰਮ ਕਰਨਗੇ।

Master of Science (Mathematics)(FYIP)
Semester–II
Session- 2025-26
Course Title: Basic Punjabi
Course Code: FMAL-2031

Time: 3 Hrs | Maximum Marks : 50
Theory : 35
CA : 15

**ਅੰਕ ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ**

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਸੈਕਸ਼ਨ ਹੋਣਗੇ।ਸੈਕਸ਼ਨ ੍ਣ ਤੱਕ ਦੇ ਪ੍ਰਸ਼ਨ ਯੂਨਿਟ ਜ਼ਜ਼ਡ ਵਿਚੋਂ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।

2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।

3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ 7 ਅੰਕ ਹਨ।

4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ ਪ੍ਰਸ਼ਨਾਂ

ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

## ਪਾਠਕ੍ਰਮ

### Unit-I

**ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ (ਨਾਂਵ, ਪੜਨਾਂਵ, ਕਿਰਿਆ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆਵਿਸ਼ੇਸ਼ਣ, ਸਬੰਧਕ,**

**ਯੋਜਕ ਅਤੇ ਵਿਸਮਿਕ)**

### Unit -II

**ਪੰਜਾਬੀਵਾਕਬਣਤਰ : ਮੁੱਢਲੀਜਾਣਪਛਾਣ**

**(ੳ) ਸਾਧਾਰਨਵਾਕ, ਸੰਯੁਕਤਵਾਕ ਅਤੇ ਮਿਸ਼ਰਤਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)**

**(ਅ) ਬਿਆਨੀਆਵਾਕ, ਪ੍ਰਸ਼ਨਵਾਚਕਵਾਕ ਅਤੇ ਹੁਕਮੀਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)**

### Unit -III

**ਪੈਰ੍ਹਾਰਚਨਾ**

**ਸੰਖੇਪ ਰਚਨਾ**

Unit -IV

**ਚਿੱਠੀਪੱਤਰ (ਘਰੇਲੂ ਅਤੇ ਦਫ਼ਤਰੀ)**

**ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ  (ਲਿਸਟ ਨਾਲ ਨੱਥੀ ਹੈ)**

Master of Science (Mathematics)(FYIP)

Semester–II
Session- 2025-26
Course Title: Punjabi Compulsory
Course Code: FMAL-2421

COURSE OUTCOMES

CO1:ਆਧੁਨਿਕ ਇਕਾਂਗੀਪੁਸਤਕ ਨੂੰ ਪੜ੍ਹਾਉਣ ਦਾਮਨੋਰਥਵਿਦਿਆਰਥੀਆਂਅੰਦਰਇਕਾਂਗੀਪ੍ਰਤੀਦਿਲਚਸਪੀ, ਸੂਝ ਨੂੰ ਪੈਦਾਕਰਨਾ ਹੈ।

CO2: ਆਧੁਨਿਕ ਇਕਾਂਗੀ ਪੁਸਤਕ ਨੂੰ ਪੜ੍ਹਾਉਣ ਦਾ ਮਨੋਰਥ ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਇਕਾਂਗੀ ਪ੍ਰਤੀ ਦਿਲਚਸਪੀ, ਸੂਝ ਨੂੰ ਪੈਦਾ ਕਰਨਾ ਹੈ।

CO3:ਮੁਹਾਵਰੇ ਅਖਾਣਦੀ ਵਰਤੋਂ ਨਾਲ ਗੱਲਬਾਤ ਵਿਚ ਪਰਪੱਕਤਾ ਆਉਂਦੀ ਹੈ।ਇਹ ਵਿਦਿਆਰਥੀਆਂ ਦੀ ਗੱਲਬਾਤ ਵਿਚ ਨਿਖਾਰ ਲਿਆਉਣ ਦਾ ਕੰਮ ਕਰਨਗੇ।

CO4:ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂਨੂੰ ਪੜ੍ਹਾਉਣ ਦਾਮਨੋਰਥਵਿਦਿਆਰਥੀਆਂਅੰਦਰਪੰਜਾਬੀਭਾਸ਼ਾ ਦੀ ਅਮੀਰੀਦਾ ਅਤੇ ਬਾਰੀਕੀਆਂਨੂੰ ਸਮਝਣਲਈਵੱਖਰੇ ਵੱਖਰੇ ਸਿਧਾਂਤਾਂਦਾਵਿਕਾਸ ਕਰਨਾ ਹੈ।

Master of Science (Mathematics)(FYIP)

Semester–II
Session- 2025-26
Course Title: Punjabi Compulsory
Course Code: FMAL-2421

**ਸਮਾਂ :** 3 ਘੰਟੇ | Maximum Marks: 50
L-T-P | Theory : 35
2-0-0 | CA :15

**ਅੰਕ ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ**

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਸੈਕਸ਼ਨ ਹੋਣਗੇ।ਸੈਕਸ਼ਨ੍ਂਣਤੱਕ ਦੇ ਪ੍ਰਸ਼ਨ ਯੂਨਿਟਜ਼ਜ਼ਜ਼ ਵਿਚੋਂ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।

2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਸੈਕਸ਼ਨ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।

3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ 7 ਅੰਕ ਹਨ।

4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ ਪ੍ਰਸ਼ਨਾਂਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

## ਪਾਠਕ੍ਰਮ ਅਤੇ ਪਾਠ ਪੁਸਤਕਾਂ

Unit-I

ਆਧੁਨਿਕ ਇਕਾਂਗੀ, ਸੰਪਾਦਕ ਰੌਸ਼ਨ ਲਾਲ ਅਹੂਜਾ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ

ਸੁਹਾਗ, ਜ਼ਫ਼ਰਨਾਮਾ, ਇੱਕ ਐਤਵਾਰ ਇਕਾਂਗੀਆਂ ਪੜ੍ਹਾਈਆਂ ਜਾਣਗੀਆਂ।

(ਸਾਰ,ਵਿਸ਼ਾਵਸਤੂ)

8 ਅੰਕ

Unit -II

ਆਧੁਨਿਕ ਇਕਾਂਗੀ, ਸੰਪਾਦਕ ਰੌਸ਼ਨ ਲਾਲ ਅਹੂਜਾ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ
ਬੰਬ ਕੇਸ, ਜੁੱਤੀਆਂ ਦਾ ਜ਼ੋੜਾ, ਕੱਚ ਦਾ ਗਜਰਾ ਇਕਾਂਗੀਆਂ ਪੜ੍ਹਾਈਆਂ ਜਾਣਗੀਆਂ।
(ਸਾਰ,ਵਿਸ਼ਾ ਵਸਤੂ)

8 ਅੰਕ

Unit -III

(ੳ) ਮੁਹਾਵਰੇ ਅਖਾਣ
(ਅ) ਘਰੇਲੂ ਚਿੱਠੀ ਪੱਤਰ8ਅੰਕ

Unit -IV

(ੳ) ਸ਼ਬਦਸ਼੍ਰੇਣੀਆਂ : ਨਾਂਵ,ਪੜਨਾਂਵ,ਕਿਰਿਆ,ਵਿਸ਼ੇਸ਼ਣ
(ਅ) ਸ਼ਬਦਸ਼੍ਰੇਣੀਆਂ: ਕਿਰਿਆਵਿਸ਼ੇਸ਼ਣ,ਸੰਬੰਧਕ,ਯੋਜਕ,ਵਿਸਮਿਕ8 ਅੰਕ

Master of Science (Mathematics)(FYIP)
Semester–II

Session- 2025-26
Course Title: Punjab History and Culture (C. 320 to 1000 A.D)
Course Code: FMAL-2431

COURSE OUTCOMES

After completing Semester II and course on Ancient History of Punjab students will be able to understand:

CO 1: The reasons and impact of Alexander's invasions and to comprehend various factors leading to rise and fall of empires and emergence of new dynasties and their administration specifically of Maurya rule in general and Ashok in particular

CO 2: art and architecture of Gupta period and the Indo-Greek style of architecture under Gandhara School

CO 3: To have an insight into the socio-cultural history under Harshvardhan and punjab under the stated period

CO 4: To enable students to have thorough insight into the various forms/styles of Architecture and synthesis of Indo - Greek Art and Architecture in Punjab

Master of Science (Mathematics) (FYIP)

Semester–II

Session- 2025-26

Course Title: Punjab History and Culture (C. 320 to 1000 A.D)

Course Code: FMAL-2431

| | |
|---|---|
| Examination Time: 3 Hours | Max. Marks: 50 |
| Credits L-T-P: 2-0-0 | Theory: 35 |
| Contact Hours: 2 Hrs/Week | CA: 15 |

Instructions for the Paper Setter:

1. Question paper shall consist of four Units
2. Examiner shall set 8 questions in all by selecting Two Questions of equal marks from each Unit.
3. Candidates shall attempt 5 questions in 500 words, by at least selecting One Question from each Unit and the 5th question may be attempted from any of the four Units.
4. Each question will carry 7 marks

Unit I

1. Alexander's Invasion's and Impact
2. Administration of Chandragupta Maurya with special reference to reforms introduced by Ashok

Unit II

3. The Kushans: Gandhar School of Art
4. Gupta Empire: Golden Period-Social and cultural life, Art and Architecture)

Unit III

5. The Punjab under Harshvardhana-Society and Religion During the time of Harshvardhana
6. Socio-cultural History of Punjab from 7th to 1000 A.D.

Unit IV

7. Development of Languages and Education with Special reference to Taxila
8. Development to Art and Architecture

Suggested Readings


- B.N. Sharma: *Life in Northern India*, Delhi. 1966
- Budha Parkash, *Glimpses of Ancient Punjab*, Patiala, 1983.
- L. M Joshi (ed), *History and Culture of the Punjab*, Art-I, Punjabi University, Patiala, 1989 (3rd edition)
- L.M. Joshi and Fauja Singh (ed.), *History of Punjab*, Vol.I, Punjabi University, Patiala, 1977.

Master of Science (Mathematics)(FYIP)

Semester–II
Session- 2025-26
Course Title: Communicative English-II
Course Code: FMAL-2102

## Course Outcomes

At the end of this course, students will be able to:

CO1: distinguish the main points from the supporting details and the irrelevant information from the relevant one through Note-Taking

CO2: learn the skills and strategies of effective writing by paragraph writing

CO3: enhance their reading and analyzing power of texts through guided reading through the study of "Making Connections" by Kenneth J. Pakenham

CO4: be acquainted to the techniques of effective essay writing

Master of Science (Mathematics)(FYIP)

Semester–II
Session- 2025-26
Course Title: Communicative English-II
Course Code: FMAL-2102

Examination Time: 3 Hours | Max. Marks: 50
Theory: 35
L T P | CA:15
2 0 0

Instructions for Paper Setters:

Eight questions of equal marks (07 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four).Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Practical question on Note Making, Summarizing and Abstracting as given in The Written Word by Vandana R. Singh

Unit II

Practical question on Paragraph writing as prescribed in The Written Word by Vandana R. Singh

Unit III

Theoretical questions based on ABC of Good Notes as prescribed in The Written Word by Vandana R. Singh, Unit-III from Making Connections: A Strategic Approach to Academic Reading by Kenneth J. Pakenham, Second Edition

Unit IV

Practical question on Essay writing from The Written Word by Vandana R. Singh,
Unit - IV from Making Connections: A Strategic Approach to Academic Reading by Kenneth J. Pakenham, Second Edition.

Text books:

- The Written Word by Vandana R. Singh, Oxford University Press, New Delhi
- Making Connections: A Strategic Approach to Academic Reading by Kenneth J. Pakenham, second edition.

Master of Science (Mathematics)(FYIP)

Semester–II
Session-2025-26
Course Title: Sequences and Series
Course Code: FMAL-2333

## Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate an understanding of sequences and series and their convergence, Cauchy criterion, sub sequence and algebra of limit of sequences.

CO 2: Know and describe the behaviour of Infinite series using various tests like comparison test, Cauchy Integral test. Ratio test, Raabe's test.

CO 3: Distinguish between the absolute convergence and conditional convergence.

CO 4: Manage to solve the problem related to Fourier series expansion, Fourier series for even and odd functions and half range series.

Master of Science (Mathematics)(FYIP)

Semester–II
Session-2025-26
Course Title: Sequences and Series
Course Code: FMAL-2333

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
L T P | CA: 30
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Sequence, sub sequence, bounded sequences, monotone sequences, convergence, Cauchy criterion, algebra of limit of sequences (proofs with ε-N rigor), Sandwich Theorem.

Unit II

Infinite series, Sequences of partial sums, convergence and divergence of series, series of non-negative terms, comparison test, Limit Comparison test, Cauchy's nth root test, Cauchy's Condensation test, Cauchy's Integral test. Ratio test, Raabe's test (all tests with proofs).

Unit III

Logarithmic test and Gauss test, Alternating series, Leibnitz Test, absolute and conditional convergence, Convergence of Power Series, Taylor Series.

Unit IV

Periodic functions, trigonometric series, Fourier series expansion, Fourier series for even and odd functions, half range series.

Text Book:

George B. Thomas and Ross L. Finney, Calculus and Analytic Geometry, Pearson publication, 9th Edition, 1998.

Reference Books:

1. S. C. Malik and S. Arora, Mathematical Analysis, New Age International Publishers, New Delhi, 2nd Edition, 2005.

2. Sudhir R. Ghorpade and B.V. Limaye, A course in calculus and real analysis, Springer, 2006.

Master of Science (Mathematics)(FYIP)

Semester–II
Session-2025-26
Course Title: Algebra
Course Code: FMAL-2334

## Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of Groups, Rings, Fields and Vector space with examples.

CO2: Understand the concepts of Linearly independent and dependent vectors, linear span, subspace generated by a subset, basis and dimension.

CO3: Understand matrix representation of a linear transformation and to determine Linear transformations, null space and range space of a linear transformation

CO 4: Obtain Eigen values, Eigen vectors and to solve the System of linear equations over a field.

Master of Science (Mathematics)(FYIP)

Semester–II
Session-2025-26
Course Title: Algebra
Course Code: FMAL-2334

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
CA: 30

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Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit-I

Definition of Group, Ring and Fields with examples. Definition of a vector space, subspaces with examples. Direct sum of subspaces

## Unit-II

Linearly independent and dependent vectors, linear span, subspace generated by a subset, basis and dimension.

## Unit-III

Linear transformations, null space and range space of a linear transformation, rank and nullity of a linear transformation, matrix representation of a linear transformation.

## Unit-IV

Elementary matrix operations and Elementary matrices, Row rank and Column rank of a matrix and their equality, System of linear equations over a field, Characteristic polynomial of a matrix, Cayley-Hamilton Theorem, Eigen values and Eigen vectors.

Text Book:

S. Axler, Linear Algebra Done Right, Springer, Second edition, 1997.

Reference Books:

1. S. H. Friedberg, A.J. Insel and L.E. Spence., Linear Algebra, PHI Learning Pvt. Ltd, New Jersey, 1979

2. V. Sahai and V. Bist., Linear Algebra, Narosa Publishing House Pvt. Ltd, Delhi, 2013

3. Andreescu, T. and Andrica, D. ,Complex Numbers from A to Z, Birkhauser,2006.

Master of Science (Mathematics)(FYIP)

Semester–II
Session-2025-26
Course Title: Object Oriented Programming C++
Course Code: FMAM-2135

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

CO1: Comprehend the concepts of Object-Oriented Programming Paradigm.

CO2: Identify the use of access specifiers and different types of constructors in class.

CO3: Apply function and operator overloading.

CO4: Comprehend different types of inheritance and polymorphism.

Master of Science (Mathematics)(FYIP)

Semester–II
Session-2025-26
Course Title: Object Oriented Programming C++
Course Code: FMAM-2135

Examination Time: 3 Hours | Max. Marks: 100
Practical-30
Theory: 40
CA: 30

L T P
3 0 1

Instructions for the Paper Setters:

Eight questions of equal marks (8 Marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

## Unit I

GettingStarted:Introduction.AbriefhistoryofC++,Variable,Constant,Expression,Statements,Comments and keywordsofC++.

Operator: Arithmetic, Relational, Logical, Assignment, Increment/Decrement, Conditional, Precedence ofOperators.Datatype, Typeconversion,libraryfunction.

Input/OutputStatements:Inputtingusingcinandoutputtingusingcoutstatements,Preprocessordirectives.

Basic Program construction: A complete C++ program: invoking Turbo C++, naming your program, usingthe editor, saving your program, compiling and linking, running the program Errors: Compiler, linker andruntime.

Other IDE features: Compiling and linking, shortcut exiting from IDE, examining files, opening an existingfile, DOSshell.

## Unit II

Programming Paradigms: Introduction to the object oriented approach towards programming by discussing Traditional, Structured Programming methodology.

Objects & Classes: Object Definition, Instance, Encapsulation, Data Hiding, Abstraction, Inheritance, Messages, Method, Polymorphism, Classes.

Object Oriented Programming using C++: Characteristics of OOP, Overview of C++, Objects and

Classes, Member functions and data, private & public, constructor & destructor, Constructor Overloading, Types of Constructors.

Unit III

Operator Overloading: Overloading unary operators, Overloading binary operators, Data conversion, Pit-fallsoperator overloadingandconversion.

Function Overloading: Function Overloading, Default Arguments, Ambiguity in Function Overloading.

Unit IV

Inheritance: Concept of inheritance, Base & derived classes, Access Specifiers, Class Hierarchies, Types of Inheritance with examples.

Polymorphism: Virtual functions, friend functions, static function, this pointer, polymorphism, Types of Polymorphism with examples, Templates

References / Textbooks:


1. Herbertt Schildt, C++: The Complete Reference, Tata McGraw-Hill Education India, 4th Edition.
2. Bjarne Stroustrup, The C++ Programming Language, Addison – Wesley Professional (2013), 4th Edition
3. G.S. Baluja, C++ Program Design (w/CD), Khanna Book Publishing Company (2015), 2nd edition.
4. Stanley Lippman, Josee Lajoie, Barbara Moo, C++ Primer, Addison-Wesley Professional (2012), 5th edition.
5. Richard Johnsonbaugh and Martin Kalin, Object Oriented Programming in C++, Pearson Education (1999), 2nd Edition

Master of Science (Mathematics) (FYIP)

Semester–II
Session-2025-26

Course Title: Algebra Laboratory

Course Code: FMAP-2336

## Course Outcomes

After passing this course, the students will be able to:

CO 1: To develop practical skills in applying computational tools for performing various matrix operations, including addition, multiplication, inversion, transposition, and determinant calculation.

CO 2: To enhance problem-solving abilities in linear algebra by determining matrix rank, reducing matrices to row echelon form, and solving systems of linear equations using numerical methods.

CO 3: To enable students to analyze and interpret matrix properties through the computation of eigenvalues, eigenvectors, and other numerical techniques using built-in software functions.

CO 4: To bridge theoretical concepts of linear algebra with practical implementation using computational packages, fostering efficiency, accuracy, and deeper understanding of engineering mathematics applications.

Master of Science (Mathematics) (FYIP)

Semester–II
Session-2025-26

Course Title: Algebra Laboratory

Course Code: FMAP-2336

Examination Time: 3 Hours

Max. Marks: 50
Practical: 35
CA: 15

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List of Practicals (using any package)

1. Introduction to the computer package in the practicals.
2. Matrix operations: addition, multiplication, inverse. transpose, determinant of matrix.
3. Find Rank of matrix: Row Rank, Column Rank.
4. Find row reduced echelon form
5. Create the coefficient matrix A and vector b. Solve for x using the inverse, using the built-in function.
6. Solving a linear system, using Gauss elimination numerically.
7. Finding eigenvalues and eigenvectors, numerically.

Reference Books:-


1. S.S. Sastry, Engineering Mathematics - Volume I (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics - Volume II (4th Edition), PHI, 2008.

Master of Science (Mathematics) (FYIP)

Semester–II
Session-2025-26
Course Title: Statistical Analysis Using Spreadsheet
Course Code: FMAL-2330

Course outcomes:

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

CO:1 Understand the basic concepts and functions of Statistics, collect and present data using tabulation and charts (including Excel/SPSS), and compute measures of central tendency such as mean, median, mode, weighted mean, geometric mean, and harmonic mean.

CO:2 Analyze variability in data by calculating and interpreting measures of dispersion including range, quartile deviation, mean deviation, standard deviation, and coefficient of variation.

CO:3 Evaluate the shape of data distribution by computing and interpreting Karl Pearson's and Bowley's coefficients of skewness and understanding the concept of kurtosis.

CO:4 Examine relationships between variables by identifying types of correlation and applying Karl Pearson's coefficient of correlation and rank correlation methods.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Statistical Analysis Using Spreadsheet

Course Code: FMAL-2330

Examination Time: 3 Hours | Max. Marks: 50

Theory: 35

L T P | CA: 15

2 0 0

Instructions for Paper Setters:

Eight questions of equal marks (7 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Introduction to statistics, functions of statistics, collection of data, presentation of data, tabulation of data, charting of data, introduction to excel/spss, graphs in excel, measures of central tendency-, mean, median - meaning and computation, mode- meaning and computation, weighted average mean, geometric mean and harmonic mean.

Unit II

Measures of dispersion, types of dispersion- range, quartile deviation, mean deviation, standard deviation, co-efficient of variation.

Unit III

Skewness- Karl Pearson co-efficient of skewness, Bowley's co-efficient of skewness and Kurtosis.

Unit IV

Correlation, Types of correlation, positive, negative, linear. methods of correlations - Karl Pearson's Co-efficient of correlation, rank correlation coefficient.

Reference Books:-

1. S.C. Gupta. Fundamentals of Mathematical Statistics, S. Chand Publication, 2000.
2. K. Berk, & P. Carey. Data Analysis with Microsoft Excel, Duxbury Press, 2000.

Master of Science (Mathematics)(FYIP)
Semester–II
Session-2025-26
Course Title: Statistical Analysis Using Laboratory
Course Code: FMAP-2330
Course Outcomes:

After passing this course, the students will be able to:

CO:1 Apply spreadsheet functions such as SUM, COUNT, COUNTIF, MAX, MIN, and SORT to perform data organization, calculation, and analysis effectively.

CO:2 Prepare and analyze academic results by calculating total marks, percentages, grades, SGPA, and credits using Spreadsheet formulae and functions.

CO:3 Construct and interpret graphical representations including histograms, bar charts, pie charts, and two-dimensional graphs for better data visualization.

CO:4 Compute and interpret statistical measures such as central tendency, dispersion, skewness, kurtosis, correlation, and regression using Spreadsheet tools.

Master of Science (Mathematics)(FYIP)
Semester–II
Session-2025-26
Course Title: Statistical Analysis Using Laboratory
Course Code: FMAP-2330

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
CA: 15

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0 0 2

List of Practicals (using excel)

1. Introduction of basics of excel and functions such as ‘sum’, ‘count’, ‘countif’, ‘max’, ‘min’, ‘sort’ etc.
2. To prepare result from the data on marks and number of credits in a given number of courses of a class based on total marks, marks obtained, percentage of marks obtained, grades, and determine SGPA for each student.
3. Create frequency distribution table; plot histogram, bar chart, pie chart, etc.
4. Plotting two dimensional graphs.
5. To find measures of central tendency for a given data.
6. To find measures of dispersion for a given data.
7. To find measures of skewness and kurtosis for a given data.
8. To find Karl Pearson Coefficient of correlation and rank correlation coefficient for a givendata.
9. To find regression coefficient for bivariate data and plotting regression lines.

Reference Books:-

1. S. C. Gupta, Fundamentals of Mathematical Statistics, Himalaya Publication.
2. K. Berk, Partrick Carey, Data Analysis with Microsoft Excel.

# SEMESTER- III

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Theory of Real Functions
Course Code: FMAL-3331

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand real number system, limit of a function, basic properties of limit, continuity, and classification of discontinuities & to apply it in real world problem.

CO 2: To understand the concept of Differentiability of functions and Uniform Continuity.

CO 3: Demonstrate Relative extrema, Mean Value Theorem and its Applications to inequalities.

CO 4: To understand the concepts of Taylor's theorem & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Theory of Real Functions
Course Code: FMAL-3331

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
CA:30

L T P
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Limit of a function ( $-\delta$ approach), Algebra of limit, One sided limits, Infinite limits and limits at infinity, Continuous functions, discontinuity criterion, Composition of continuous functions.

Unit II

Continuous functions on an interval, Bolzano's Intermediate Value Theorem, Uniform Continuity, Differentiability of a function at a point and in an interval, Algebra of differentiable functions, Chain Rule.

Unit III

Concavity and convexity, points of inflexion, Rolle's theorem, Mean Value Theorem and its Applications to inequalities, Cauchy Mean Value Theorem, L' Hospi- tal's Rule.

Unit IV

Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, Application of Taylor's theorem, Taylor's series and Maclaurin's series expansions of ex- ponential and trigonometric functions.

Text Book:

Bartle, R. G. and Sherbert, D. R., Introduction to Real Analysis, 3rd Ed., John Wiley and Sons(Asia) Pvt. Ltd., Singapore, 2002.

Reference Books:

1.Rudin, W., Principles of Mathematical Analysis, 3rd edition. McGraw Hill, 1976.

2. Apostol, T. M., Mathematical Analysis, 2nd Edition, Narosa Publishing House, Reprint 2002.

3. Ghorpade, S. R. and Limaye, B. V., A Course in Calculus and Real Analysis, Springer, 2006.

4. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.

5. Ross, K.A., Elementary Analysis: The theory of Calculus, Springer 2004.

Master of Science (Mathematics)(FYIP)

Semester–III
Session-2025-26
Course Title: Applied Differential Equations
Course Code: FMAL-3332

After the successful completion of this course, the students will be able to:
CO1: Identify differential equation, its order and degree, exact differential equations and special rules to find integrating factors.

CO2: Apply the Decay model to solve real life problem and analyze the dynamics of pollutant accumulation in a lake using differential equations.

CO 3: Demonstrate the concept of Linear homogeneous and non-homogeneous equations with constant coefficients, The Cauchy Euler Equations, Method of variation of parameters.

CO 4: Analyze the System of ordinary differential equations, Power Series, convergence of power series and Radius of convergence.

Master of Science (Mathematics)(FYIP)

Semester–III

Session-2025-26

Course Title: Applied Differential Equations

Course Code: FMAL-3332

Examination Time: 3 Hours | Max. Marks: 100

Theory: 70

L T P | CA:30

4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four).Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Classification of Differential Equations, their origin and application, solutions, initial value problems, boundary value Problem and existence of Solutions. Exact differential equations and integrating factors, sep- arable equations and equations reducible to this form, linear equation and Bernoulli equations, special inte- grating factors and transformations.

Unit II

Orthogonal and oblique trajectories. Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), exponential growth of population, limited growth of population, drug assimilation into the blood (case of a single cold pill)

Unit III

General solution of homogeneous equation of second order, principle of superposition for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations with constant coefficients, The Cauchy Euler Equations, Method of variation of parameters.

Unit IV

Power Series solution about an ordinary point, solutions about singular points, the method of Frobenius, Bessel equation and Bessel function and their reccurence relations.

Text Book:

S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Reference Books:


1. Barnes, B., and Fulford, G. R., Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. Edwards, C.H. and Penny, D.E., Differential Equations and Boundary Value problems Computingand Modeling, Pearson Education India,2005.
3. Abell, M.L., Braselton, J. P., Differential Equations with MATHEMATICA, 3rd Ed., ElsevierAcademic Press, 2004.
4. Boyce, W.E., and Diprima, R.C., Elementary differential equations and boundary value problems,John Wiley & Sons, 8th edition, 2005.

Master of Science (Mathematics) (FYIP)
Semester-III
Session: 2025-26
Course Title: Logic and Reasoning
Course Code: FMAL-3333

Course Outcomes:
After passing this course, the students will able to:

CO1.Understand and apply concepts of verbal reasoning including classification, analogy, and series.

CO2. Develop skills to solve puzzles and apply mathematical logic in reasoning problems.

CO3. Analyze and interpret non-verbal reasoning problems through visualization and logic pattern identification.

CO4. Develop problem solving skills in visual-spatial reasoning through figure manipulation and recognition.

Master of Mathematics (FYIP)
Semester-III
Session: 2025-26
Course Title: Logic and Reasoning
Course Code: FMAL-3333

Examination Time: 3 Hours | Maximum Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instruction for the Paper Setters:

Eighth questions of equal marks (14 marks each) are to be set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding fours). Candidates are required to attempt five questions, selecting at least one questions from each section. The fifth question may be attempted from any sections.

## Unit – I

Verbal Reasoning: Series Completion, Number and Alphabet analogy, Missing number in a sequence or a series, Classification, Coding and Decoding, Blood Relationship.

## Unit-II

Puzzle test, Direction Sense test, Logical Venn Diagram, Mathematical operations, Arithmetical Reasoning, Inserting the missing character, Logic

## Unit-III

Non-Verbal Reasoning: Series, Analogy, Classification, Analytical reasoning, Mirror Images, Water Images, Spotting out of the embedded figures. Vocabulary: Antonym, synonym, phrases

## Unit-IV

Non-Verbal Reasoning: Completion of Incomplete pattern, Figure Matrix, Paper Folding, Rule Detection, Grouping of identical Figures, Cubes and dice, Construction of squares and triangles.

Text-Book:

R.S Aggarwal, A Modern approach to Verbal and Non-Verbal Reasoning, S. Chand and Co. Pvt. Ltd, New Delhi, Eighth Edition, 2018

Reference Books:

1. M.K Pandey, Analytical reasoning, BSC Publishing Co. Pvt. Ltd., 2024 Edition.
2. Mishra & Kumar, Multidimensional Reasoning, Arihant Publication, Latest Edition 2024.
3. Course in Mental Abilities and Quantitative Aptitude for Competitive Examinations by Edgar Thorpe, Tata McGraw Hill Pub. Co. Ltd. New Delhi.

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Basics of Python Programming
Course Code: FMAM-3334

Course Outcomes:

After completion of this course, the students will be able to:

CO1: Comprehend basics of Python programming like operators, data types, etc.

CO2: Apply various control statements of Python Programming Language for designing solutions to different real world problems.

CO3: Implement various built-in and user defined function, packages and modules to solve mathematical problems.

CO4: Apply different matrix operations and perform file manipulations.

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Basics of Python Programming
Course Code: FMAM-3334

Examination Time: (3+3) Hours | Max. Marks: 100
Practical-30
Theory: 40
CA: 30

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Instructions for Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Introduction to python: Features of Python, How to Run Python, Identifiers, Reserved Keyboards, Variables, Comments in Python, Indentation in Python, Multi-Line Statements, Multiple Statement Group (Suite), Quotes in Python, Input, Output and Import Functions, Operators, Data Types and Operations: Numbers, String, Lists, Tuple, Set, Dictionary, Mutable and Immutable Objects, Data Type Conversions

## Unit II

Flow Control: Decision Making, Loops, Nested Loops, Control Statements, Types of Loops. Functions: Function Defining in Python, Function Calling, Function Arguments, Anonymous (Lambda) Functions, Recursive Functions, Function with more than one return value.

Math Module: Constants, Arithmetic functions, Power functions, Logarithmic functions

## Unit III

Modules and Packages: Built-in modules, Creating Modules, Import Statement, Locating Modules, Namespaces and scope, The dir() function, The reload() function, Packages in Python, Date and Time Module. Math Module: Trigonometric and Angular functions.

## Unit IV

File Handling: Opening a File, Closing a File, Writing to a File, Reading from a File, File Methods, Renaming a File, Deleting a File, Directories in Python. Math Module: Matrix

operations (Multiplication. Addition, matrix multiplication, inverse, determinant, adjoint, Eigenvalues).

References Books:


1. Jeeva Jose, P. Solan Lal, Introduction to Computing and Problem Solving with Python, Publisher of Science, Technology and Engineering Books, 2022
2. John V. Guttag, Introduction to Computation and Programming Using Python, PHI Learning Pvt. Limited Second Edition, 2016.

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Applied Differential Equations Laboratory
Course Code: FMAP-3335

Course Outcome:

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

CO1:Apply analytical and graphical techniques to solve and visualize first and second-order differential equations, including plotting solutions for single and family of equations.

CO2:Implement numerical methods, specifically the Runge-Kutta method, to solve systems of ordinary differential equations.

CO3:Model and solve real-life exponential growth and decay problems, interpreting the behavior of dynamic systems over time.

CO4:Analyze and simulate real-world models such as lake pollution and population growth (with and without harvesting) using differential equations with constant or variable parameters.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Applied Differential Equations Laboratory

Course Code: FMAP-3335

Examination Time: 3 Hours | Max. Marks: 50

Practical: 35

L T P | CA:15

0 0 2

List of Practicals (using any software)

1. Plotting solution of first order differential equation.
2. Plotting of solution of family of second order differential equation.
3. Solution of system of ordinary differential equations, numerically using Runge-Kutta method.
4. Growth & Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Limited growth of population (with and without harvesting).

Reference Books:

1. Barnes, B., and Fulford, G. R., Mathematical Modeling with Case Studies, A Differential Equation Ap- proach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. Edwards, C.H. and Penny, D.E., Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India,2005.
3. Abell, M.L., Braselton, J. P., Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
4. Boyce, W.E., and Diprima, R.C., Elementary differential equations and boundary value problems, John Wiley & Sons, 8th edition, 2005.
5. Ross, S. L., Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Graph Theory
Course Code: FMAL-3330

After completion of this course, the students will be able to:

CO1: Achieve command of the fundamental definitions and concepts of graph theory.

CO2: Develop a graph theoretical model for real life situations.

CO3: Understand the structures, applications, and algorithms related to tree data structures.

CO4: Evaluate or synthesize any real world applications using graph theory based on directed or unidirected graphs in networks.

Master of Science (Mathematics) (FYIP)

Semester–III
Session-2025-26
Course Title: Graph Theory
Course Code: FMAL-3330

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
CA:30

L T P
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Graph and its terminology: vertex, edge, types of vertex and edges, incidence matrix and diagram of a graph, order and size of graph, null graph, isomorphic graph, homeomorphic graph, finite and infinite graph, subgraphs and its types, Complement of a graph, Dual graphs, complete graph, regular graph, bipartite, weighted graph, planar graph

## Unit II

Walk, path and its length, Cycle and its length, connected and disconnected graph, Shortest path in weighted graph, Eulerian paths and circuits, Hamiltonian paths and circuits

## Unit III

Tree, distance and centers in a tree, rooted tree, binary tree, spanning tree, minimum spanning tree in a weighted graph, Kruskal's algorithm, Prim's algorithm

## Unit IV

Graph coloring, vertex coloring, chromatic polynomial, chromatic number, algebraic operations in graph, Directed graph, out degree and in degree of a vertex, matrix and diagrammatic representation of directed graph

Text Book:

Gupta, S.B. and Gandhi, C.P. , Discrete Structures, 4th edition, University Science Press, New Delhi. India.

# SEMESTER-IV

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Number Theory
Course Code: FMAL-4331

## Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Understand congruences and solve system of linear congruences.

CO 2: Understand concepts and applications of Number theoretic functions.

CO 3: Understand the existence of primitive roots for all integers

CO 4: Identify representation for an integer as sum of squares

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Number Theory
Course Code: FMAL-4331

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
CA:30

L T P
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Basic properties of congruences, linear congruences and its properties, simultaneous linear congruences, Chinese Remainder Theorem , Fermat's Little theorem, Wilson's theorem and its applications.

Unit II

Number theoretic functions, number of divisors and sum of divisors of a natural number, multiplicative functions, the Mobius function, the Mobius Inversion formula, Euler's phi-function and its properties, Euler's theorem.

Unit III

Order of an integer modulo n, primitive roots for primes, Composite numbers having primitive roots, Theory of Indicies and its properties, Table of Indices, Quadratic residues modulo primes, Euler's criterion.

Unit IV

The Legendre symbol and its properties, Gauss Lemma, Quadratic reciprocity law, Jacobi Symbol, and its properties, Pythagorean triplet, the Diophantine equations: $x^2 + y^2 = z^2, x^4 + y^4 = z^2, x^4 + y^4 = z^4$.

Text Books:


1. Burton, D.M., Elementary NumberTheory, 6th Ed.,TataMcGraw-Hill, Indianreprint,2007.
2. Niven, I., Zuckerman, H.S. and Montgomery, H.L., An introduction to the theory of numbers, 5th edition, oxford university press, oxford, 1991.

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Numerical Analysis
Course Code: FMAL-4332

After passing this course, the students will be able to:

CO 1. Know how to find the roots of transcendental and polynomial equations.

CO 2. Perform computation for solving a system of equations.

CO 3. Learn how to interpolate the given set of values.

CO 4. Learn numerical solution of differential equations & compute numerical integration and differentiation, numerical solution of ordinary differential equations.

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Numerical Analysis
Course Code: FMAL-4332

Examination Time: 3 Hours | Max. Marks: 100
Theory: 70
L T P | CA:30
4 0 0

Instructions for Paper Setters:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Errors: Relative, absolute, round off, truncation, Transcendental and polynomial Equations: Bisection Method, Regula-Falsi Method, Secant Method, Newton's Method, Rate of convergence of these methods, Newton's method for multiple roots.

Unit II

System of linear algebraic equations: Gaussian Elimination, Gauss Jordan, LU decomposition method , Jacobi method, Gauss-Seidel Method.

Unit III

Interpolation: Finite Difference Operators, Newton Forward and backward difference interpolation, La-grange's Method, Newton's Divided Difference Formula.

Unit IV

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 rd Rule, Simpson's 3/8 th Rule, Ordinary differential Equations: Picard's Method, Taylor's series method, Euler's Method, modified Euler's method, Runge-Kutta Methods of all orders.

Text Book:

Jain, M.K., Iyengar, SRK and Jain, R. K., Numerical methods for Scientific and Engineering Computation, New age International, 2007.

Reference Books:

1. Sastry, S. S., Introductory Methods of Numerical Analysis, Prentice Hall of India, 2012.
2. Bradie, B., A friendly introduction to Numerical Analysis, Pearson Education, 2007.

Master of Science (Mathematics)(FYIP)

Semester-IV
Session: 2025-26
Course Title: Quantitative Aptitude for Banking
Course Code: FMAL-4333

Course Outcomes:
After passing this course , the students will able to :

CO1 : Understand and solve the problems based on number system, algebraic expression and arithmetic operations with speed and accuracy

CO2: Apply arithmetic principles to practical business and daily life problems involving percentages, ratios and equation.

CO3: Analyze and compute time-based problems and financial calculations involving interest and mixture concepts.

CO4: Solve logical and data interpretation problems and develop skills in handling quantitative reasoning questions.

Master of Mathematics (FYIP)
Semester-IV
Session: 2025-26
Course Title: Quantitative Aptitude for Banking
Course Code: FMAL-4333

Examination Time: 3 Hours | Maximum Marks: 100

L T P | Theory: 70

4 0 0 | CA: 30

Instruction for the Paper Setters:

Eighth questions of equal marks (14 marks each) are to be set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding fours). Candidates are required to attempt five3 questions, selecting at least one questions from each sections. The fifth question may be attempted from any sections.

## Unit – I

Number system, H.C.F and L.C.M of Numbers , Decimal fractions, Simplification, squares and Cube roots , Average , Problem on numbers, Problem on ages, Surds and Indices, Logarithms

## Unit-II

Percentage, Profit and loss , Ratio and proportion, Partnership , Chain Rule, Pipes and Cisterns Quadratic Equation, , Height and Distance

## Unit-III

Time and work, Time and Distances, Boats and Streams, Problem on Trains, Alligation or Mixtures, Simple interest , Compound Interest , Stock and Share

## Unit-IV

Calendar Problem, Clock problem, True Discount, Banker's Discount, Data interpretation.

Text Book:

R.S Aggarwal, Quantitative Aptitude for Competitive Examination, S.Chand Co. Pvt. Ltd, New Delhi, Eighth Edition, 2017

Reference Books:


1. Arun Sharma , How to prepare for Quantitative aptitude for CAT McGraw Hill Education, $10^{th}$ edition (2023).
2. Sarvesh K. Verma, Quantitative Aptitude Quantum CAT , Arihant Publications,latest edition 2024.
3. Course in Mental Abilities and Quantitative Aptitude for Competitive Examinations by Edgar Thorpe, Tata McGraw Hill Pub. Co. Ltd. New Delhi.

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Statistical Computing Using R Programming
Course Code: FMAM-4134

Course Outcomes:

After passing this course the student will be able to:

CO1: Comprehend basics of Statistical Computing and managing data structures like vector, matrix, etc.

CO2: Create, operate and manage lists and data frames.

CO3: Apply control and I/O statements for generating outputs.

CO4: Simulate various descriptive and analytical algorithms using R language along with their visualization.

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Statistical Computing Using R Programming
Course Code: FMAM-4134

Examination Time (3+3) Hours | Max. Marks: 100
Theory: 40
Practical: 30
CA:30

L T P
3 0 1

Instructions for Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Data Statistics: Sampling, Cumulative statistics, Statistics for Data frames, matrix objects and lists.

Introduction to R, Help functions in R, Vectors, Common Vector Operations, Using all and any function, subletting of vector. Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, lists, Creating lists, general list operations, Accessing list components and values, applying functions to lists, recursive lists

## Unit II

Creating Data Frames – Matrix-like operations in frames , Merging Data Frames, Applying functions to Data frames, Factors and Tables , factors and levels , Common functions used with factors , string operations

## Unit III

Input/ Ouput: scan() , readline() Function, Printing to the Screen Reading and writing CSV and text file. Control statements: Loops, Looping Over Nonvector, Sets, if-else , writing user defined function, scope of the variable, R script file

## Unit IV

Graphics in R: Graph Syntax ((title, xlabel, ylabel, pch, lty, col.), Simple graphics (Bar, Multiple Bar, Histogram, Pie, Box-Plot, Scatter plot, qqplot), Low-level and High-Level plot functions, par() command to generate multiple plots.

Note:

Practical: Based on simple mathematical problems and based on syllabus of Statistical Methods for descriptive Statistics.

References Books:


1. Andrie de Vries and Joris Meys, R Programming for Dummies, Wiley (2016), 2nd Edition.
2. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (2017), 1st Edition.
3. Sandip Rakhsit, Statistics with R Programming, McGraw Hill Education (2018), 1st Edition.
4. Garrett Grolemund, Hands on Programming with R, O'Reilly (2014), 1st Edition
5. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley (2013)
6. Tilman M. Davies, The Book of R: A first Course in Programming and Statistics, No Strach Press (2016), 1st Edition

Master of Science (Mathematics)(FYIP)

Semester–IV
Session-2025-26
Course Title: Numerical Analysis Laboratory
Course Code: FMAP-4335
Course Outcomes:

CO1: Apply basic programming constructs to perform mathematical computations, such as calculating harmonic sums and finding absolute values.

CO2:Solve nonlinear equations using numerical techniques like the Bisection Method, Newton-Raphson Method, Secant Method, and Regula Falsi Method.

CO3:Analyze and solve systems of linear equations using direct and iterative methods, including LU Decomposition, Jacobi, and Gauss-Seidel Methods.

CO4:Use interpolation and numerical integration/differentiation techniques to approximate solutions, including Lagrange/Newton interpolation, Simpson's rules, Euler's method, and Runge-Kutta methods.

Master of Science (Mathematics)(FYIP)

Semester–IV
Session-2025-26
Course Title: Numerical Analysis Laboratory
Course Code: FMAP-4335

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
L T P | CA:15
0 0 2

Practical (Using any Software)

List of Practical's (using any software)

1. Calculate the sum1/1+1/2+1/3+1/4+ ----------+1/N.
2. To find the absolute value of an integer.
3. Bisection Method.
4. Newton Raphson Method.
5. Secant Method.
6. Regula Falsi Method.
7. LU decomposition Method.
8. Jacobi Method.
9. Gauss Seidel Method.
10. Lagrange Interpolation or Newton Interpolation.
11. Simpson's rules.
12. Euler's Method
13. Runge-Kutta Method

Text Book:

Jain, M.K., Iyengar, S. R. K., and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher,India,2007.

Reference Books:

1. Jain, C., Advanced Programming in SCILAB, Alpha Science International, Oxford, UK, 2020.
2. Campbell, S.L., Chanceller, J.P., Nikoukhah, R. Modeling and Simulation in Scilab/Scios,Springer, 2006.
3. Bradie, B., A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
4. Gerald, C. F. and Wheatley, P. O., Applied Numerical Analysis, Pearson Education, India, 2008.
5. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI LearningPrivate Limited, 2013.

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Statistical Methods
Course Code: FMAM-4330

Course Outcomes

CO1: Explain the scope, applications, and limitations of statistics, and distinguish between population and sample. To Compute and interpret measures of central tendency, dispersion, skewness, and kurtosis, including the use of box-and-whisker plots.

CO2: Analyze relationships between two attributes using 2×2 tables to assess consistency, independence, and association and Apply the principles of least squares to perform simple linear regression and fit polynomial and exponential curves; interpret residual plots.

CO3: Convert fixed base index numbers to chain base and vice versa, and evaluate errors in index numbers using appropriate tests. To Construct various types of index numbers (Laspeyre's, Paasche's, Edgeworth-Marshall, Fisher's Ideal) and understand the concepts of weighted and unweighted index numbers.

CO4**:** Decompose time series data into components and determine trends using graphical, mathematical, and moving average methods. Measure seasonal variations using ratio-to-moving-average and ratio-to-trend methods.

Master of Science (Mathematics) (FYIP)

Semester–IV
Session-2025-26
Course Title: Statistical Methods
Course Code: FMAM-4330

Examination Time: (3+3) Hours | Max. Marks: 100
Practical-30
Theory: 40
CA: 30

L T P
3 0 1

Instructions for Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Descriptive Statistics: Definition and scope of Statistics, limitations of statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Collection and tabulation of data. Diagrammatic representation of frequency distribution: histogram, frequency polygon, frequency curve, ogives, stem and leaf plot, pie chart. Measures of central tendency, dispersion, box and whisker plot, skewness and kurtosis.

Unit II

Data on two attributes, consistency, independence, and association of attributes in 2x2 tables. Linear re- gression: Simple linear regression, principle of least squares and fitting of polynomials and exponential curves, residual plots. Correlation: scatter diagram, Karl Pearson's and rank correlation, Partial and multiple correlation (3 variables only)

Unit III

Index Numbers: Definition, construction of index numbers and problems, weighed and unweighted in- dex numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's Ideal Index numbers. . Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Errors in Index numbers and tests to measure errors in index numbers. Cost of living index numbers. Uses and limitations of index numbers.

Unit IV

Time Series: Introduction and components of time series. Trend determination: by graphical methods, mathematical curve fitting and by moving average methods. Measurement of seasonal variations: ratio to moving average method, ratio to trend method. Auto regression series: first and second order auto- regression.

Introduction to auto correlation and Correlogram.

Text Books Recommended:

Goon A.M., Gupta M.K. and Dasgupta B., Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.

Gupta, S. C. and Kapoor, V.K., Fundamentals of Mathematical Statistics, 4th Edition (Reprint), Sultan Chand & Sons, 2008.

Reference Book Recommended:

Gupta, S. C. and Kapoor, V.K., Fundamentals of Applied Statistics, Sultan Chand & Sons, 2008.

# SEMESTER-V

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025 -26
Course Title: Number Theory
Course Code: FMAL-5331

## Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Find solutions of specified linear Diophantine equation and system of linear congruences.

CO 2: Apply Fermat's to prove relation involving prime numbers.

CO 3: Apply the Wilson's and Euler's theorem to solve numerical problems and explore properties of phi function in real world problems.

CO 4: Understand application of important arithmetic functions.

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025 -26
Course Title: Number Theory
Course Code: FMAL-5331

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 80
3 1 0 | CA: 20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

The question paper must contain 30% of the article/theory from the syllabus.

## Unit I

The Diophantine equation ax + by = c and its solution, Basic properties of congruences, Complete and Reduced set of residues modulo n, Special divisibility tests.

## Unit II

Polynomial conguences, Langrange's theorem, Linear congruences, Chinese remainder theorem, The Fermat's theorem, Pseudo prime, Absolutely Pseudo prime.

## Unit III

Wilson's theorem. Euler's Phi function, Euler's theorem, some properties of the Phi Function, Gauss theorem.

## Unit IV

Number-Theoretic functions: The Sum and Number of divisors, The Mobius Inversion formula, The Greatest integer function for treating divisibility problems.

Text Book:

D. Burton, Elementary Number Theory, McGraw-Hill Education, Boston, Seventh edition, 2012 (Scope as in Chapters 2, 4-7).

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025 -26
Course Title: Discrete Mathematics
Course Code: FMAL-5332
Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Understand Boolean algebra , K-Map and application of Boolean Algebra to switching circuits.

CO 2: Understand the use of Graphs and Models.

CO 3: Understand the language of trees with various types of trees and methods of traversing trees.

CO 4: Have substantial experience to comprehend formal logical and write an argument using logical notation and determine if the argument is valid or not.

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025 -26
Course Title: Discrete Mathematics
Course Code: FMAL-5332

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Boolean Algebra – Boolean Algebra, Unary Operation, Binary Operation, Laws of Boolean Algebra, Principle of Duality, Boolean Function, Fundamental Product, Sum of Product form, Complete sum of Product form, Minterm, Disjunctive Normal form, Conjunctive Normal form, obtaining a Disjunctive Normal form, obtaining a Conjunctive Normal form, Karnaugh Map upto four variables, Applications of Boolean Algebra to Switching Circuits.

## Unit II

Graph, Subgraph, Paths, Directed and Undirected graphs, Connected graphs, Weakly connected graphs, Regular and bipartite graphs, Weighted graphs, Euler path and graphs, Hamiltonian path and graphs, planar graphs.

## Unit III

Chromatic number in graphs, shortest path in weighted graphs. Tree, directed tree, ordered tree, Binary tree, traversing binary tree, spanning tree, minimum spanning tree, Kruskal's algorithm to find minimum spanning tree.

## Unit IV

Propositional Calculus – Basic Logic Operations, Statement, Proposition, Propositional Variables, Truth Table, Combination of Propositions, Laws of the Algebra of Proposition, Variations in Conditional Statement, Principle of Duality, Logical Implication, Logical Equivalence of Proposition, Tautologies, Contradiction, Contingency, Argument, Proof of Validity, Quantifiers, Existential Quantifier, Universal Quantifier, Negation of Quantified Propositions, Propositions with Multiple Quantifier.

Text Book:

S. B. Gupta and C. P. Gandhi, Discrete Structures, University Science Press, Second edition, 2010 (Scope as in Chapters: 10, 11, 12, 13).

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025 -26
Course Title: Linear Integral Equations
Course Code: FMAL-5333
Course Outcomes

On satisfying the requirements of this course, students will have the Knowledge of:

CO 1: Concept of Linear Integral equations and various kinds of Kernels, Volterra and Fredholm Integral equations of first and Second kind, reduction of initial value problem to a Volterra Integral equation and solution of Volterra Integral equation using method of Resolvent Kernel.

CO 2: Reduction of Boundary Value Problem to Fredholm Integral Equation and techniques to solve homogeneous and non-homogeneous Fredholm Integral equations.

CO 3: Laplace Transform and its basic properties and how to find solution of Volterra Integral Equations using Laplace Transform.

CO 4: Construction of Green's function and application of Green's function in finding the solution of Boundary Value Problem.

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025 -26
Course Title: Linear Integral Equations
Course Code: FMAL-5333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Linear integral equations of the first and second kind of Fredholm and Volterra type, some basic identities, Types of kernels: Symmetric kernel, Separable kernel, Iterated kernel, resolvent kernel, Initial value problems reduced to Volterra integral equations, Solution of Volterra integral equation using: Resolvent kernel, Successive approximation.

Unit II

Boundary value problems reduced to Fredholm integral equations, Solution of Fredholm integral equations using separable kernel, resolvent kernel. Methods of successive approximation to solve Fredholm equations of second kind. Solution of Homogeneous Fredholm integral equation: Eigen values, eigen vectors.

Unit III

Integral transforms for solving integral equations: Basic properties of Laplace transforms, Solution of Abel's equation using Laplace transform, Application of Laplace transform to the Solution of Volterra integral equations with convolution type kernels.

Unit IV

Green's function, Basic four properties of the Green's function, Procedure for construction of the Green's function by using its basic four properties, Construction of Green's function for boundary value problems, Solution of boundary value problems using Green's function, reducing boundary value problems to an integral equation using Green's function.

Text Book:

M.D. Raisinghania, Integral Equations & Boundary Value Problems, S. Chand Co. Pvt. Ltd., New Delhi, First Edition, 2007 (Scope as in Chapters 1-6, 9, 11).

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025-26

Course Title: Riemann Integration

Course Code: FMAL-5334

Course outcomes

After passing this course, the students will be able to:

CO 1: To understand the concepts of Riemann sum, partitions, Upper and lower Riemann integrals, Refinement of partitions, Darboux's Theorem and Necessary and sufficient conditions for Integrability.

CO 2: To know and describe the Particular classes of Integrable functions, Properties of Integrable functions, Integrability of the sum, difference, product, quotient and modulus, First and second mean value theorems of integral calculus.

CO 3: Explain the concept of Improper Integrals and conditions for existence, Comparison test for convergence of improper integrals, Abel's Test and Dirichlet test for convergence.

CO 4: To distinguish between the absolute convergence and conditional convergence and find the relation between Beta and Gamma functions & their converging behaviour

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025-26
Course Title: Riemann Integration
Course Code: FMAL-5334

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Definition and Existence of the Riemann Integral, Partitions and Riemann (or Darboux) sums, Some properties of Darboux Sums, Upper and lower Riemann integrals, Refinement of partitions, Darboux's Theorem, Necessary and sufficient conditions for integrability.

## Unit II

Particular classes of Integrable functions, Properties of integrable functions, Integrability of the sum, difference, product, quotient and modulus, The Fundamental theorem of integral calculus, First and Second mean value theorems of integral calculus.

## Unit III

Improper Integrals and conditions for existence, Comparison test for convergence of improper integrals, Abel's Test and Dirichlet test for convergence.

## Unit IV

Absolute convergence and conditional convergence of improper integrals, Beta and Gamma functions, Properties of Beta functions, Recurrence formulae for Gamma function, Relation between Beta and Gamma functions.

Text Book:

S. Narayan and M. D. Rai Singhania, Elements of Real Analysis, S. Chand & Co. Pvt. Ltd., New Delhi, Seventeenth Edition, 2016 (Scope as in chapters: 13, 16, 20).

Reference Books:

1. A. Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, Taylor & Francis Group, New York, First Edition, 2014 (Scope as in chapters: 6).

2. S. C. Malik and S. Arora, Mathematics Analysis, New Age International Publishers, New Delhi, Second Edition, 2005 (Scope as in chapters: 9,11).

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025-26
Course Title: Metric Spaces
Course Code: FMAL-5335
Course outcomes

After passing this course, the students will be able to:

CO1: Explain the fundamental concepts of Metric Spaces and their role in modern mathematics.

CO2: Understand the concept of compact sets , separated sets and state and prove Heine – Borel theorem

CO3: Demonstrate sequence in a metric space and give argument related to convergence.

CO4: Give argument related to continuity, completeness, compactness, connectedness in metric spaces.

Master of Science (Mathematics) (FYIP)
Semester–V
Session: 2025-26
Course Title: Metric Spaces
Course Code: FMAL-5335

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Metric on a set, Metric space, definitions and examples, open sets, interior and closure of a set, closed set, dense and nowhere dense sets, exterior, frontier and boundary points and their properties.

## Unit II

Compact subsets of a metric space, elementary properties of compact sets, Heine-Borel theorem, separated sets, connected subsets of a metric space.

## Unit III

Sequences in a metric space, Convergent Sequences, Cauchy Sequences, Complete Metric Spaces, Cantor's Intersection Theorem, Baire's Category Theorem.

## Unit IV

Continuous Functions in a metric space, continuity and compactness, continuity and connectedness, discontinuities, monotonic functions, uniform continuity

Text Book:

S. Narayan and M. D.Raisinghania, Elements of Real Analysis, S. Chand& Company, New Delhi, 12th Edition, 2011 (Scope as in Chapter- 19)

Reference Books:

1.S. C.Malik and S. Arora, Mathematics Analysis, New Age International Publishers, New Delhi, 5th Edition, 2021 (Scope as in Chapter- 19)

2.W. Rudin, Principles of Mathematical Analysis, McGraw-Hill Education, New York, 3rd Edition, 1976 (Scope as in Chapters- 2, 3(3.1-3.12), 4)

# SEMESTER-VI

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025 -26
Course Title: Complex Analysis
Course Code: FMAL-6331

Course outcomes

After passing this course, the students will be able to:

CO1: Justify the need for a complex number system and explain how it is related to other existing number system. Define a function of complex variable, limit, continuity and differentiability, Analytic functions, Conjugate function, Cauchy Riemann equations, Harmonic function and carry out basic mathematical operations with complex numbers.

CO2: State and prove Cauchy's theorem, Cauchy's integral formula, Cauchy's inequality, Poisson's integral formula, Morera's theorem and Liouville's theorem.

CO3: Define singularities of a function, know the different types of singularities and be able to determine the Residue at singularities of a function.

CO4: Learn The Fundamental Theorem of Algebra, The Argument principle, Rouche's theorem, Conformal transformations, Bilinear transformations, Critical points, Fixed points, and Problems on cross ratio and bilinear transformation.

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Complex Analysis
Course Code: FMAL-6331

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Functions of complex variables, Topology of real line and complex plane, limit, continuity and differentiability, Analytic functions, Conjugate function, Cauchy Riemann equations (Cartesian form), Harmonic function, Construction of analytic functions.

## Unit II

Complex line integral, Cauchy's theorem, Cauchy's integral formula and its generalized form, Cauchy's inequality, Poisson's integral formula, Morera's theorem, Liouville's theorem.

## Unit III

Taylor's theorem, Laurent's theorem, Zeros and Singularities of an analytic function, Residue at a pole and at infinity, Cauchy's Residue theorem.

## Unit IV

The Fundamental Theorem of Algebra, The Argument principle, Rouche's theorem, Conformal transformations, Bilinear transformations, Critical points, Fixed points, The cross ratio, Problems on cross ratio and bilinear transformation.

Text Book:

S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, New Delhi, Second Edition, 1995 (Scope as in Chapters: 1-5).

Reference Books:

1. S. Narayan, Theory of Functions of a Complex Variable, S. Chand Co. Pvt. Ltd., New Delhi, Fourth Edition, 2009 (Scope as in Chapters: 3, 5, 7, 9, 11).

2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw-Hill Education, New York, Eighth Edition, 2004 (Scope as in Chapters: 1, 2, 4, 5, 6, 7, 9).

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Analytical Skills
Course Code: FMAL-6332

Course outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of sequence and series, clock problems, blood relationship.

CO 2: Demonstrate procedural fluency with real number arithmetic operations and use these operations to represent real world scenarios and to solve stated problems and demonstrate number sense and conversion between fractions, decimals and percentages.

CO 3: Use simple and compound interest to do business calculations such as value of money, maturity value, present value, future value and able to differentiate which math method should be used for different problems and understand the concept of mensuration.

CO 4: Analyse data being presented in the form of tables, Venn diagrams, pie charts.

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Analytical Skills
Course Code: FMAL-6332

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Sequence and Series: Analogies of Numbers and Alphabets, Completion of blank spaces following the pattern in A: b::C: d relationship, Odd thing out, Missing number in a sequence or a series.
Date, Time and Arrangement Problems: Calendar Problems, Clock Problems, Blood Relationship.

Unit II

Arithmetic Ability: Algebraic operations BODMAS, Fractions, Decimals Fractions, Divisibility rules, LCM & GCD (HCF), Elementary Algebra.
Quantitative Aptitude: Averages, Ratio and proportion, Problems on ages, Time and Work, Work and Wages, Pipes and Cisterns, Time and Distance, Trains, Streams.

Unit III

Mensuration: Measurement of Areas, Surface Areas and Volume.
Business Computations: Percentages, Profit & Loss, Partnership, Simple and Compound Interest.

Unit IV

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

Reference Books:

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Co. Pvt. Ltd., New Delhi, Eighth Edition, 2017 (Scope as in Chapters:1-4, 6, 8, 11-14, 16-20, 22-23, 27-28, 35 (Section I) and Chapters 36-39 (Section II)).
2. R.V. Praveen, Quantitative Aptitude and Reasoning, PHI Learning Pvt. Ltd., Delhi, Third Edition, 2016 (Scope as in Chapters: 1, 4-8, 13-21, 23-29, 32, 34, 36, 39 (Part I) and Chapters 1,3,5 (Part II)).

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Numerical Analysis
Course Code: FMAL-6333
Course Outcomes

After passing this course, the students will be able to:

CO 1. Know how to find the roots of transcendental equations.

CO 2. Perform computation for solving a system of equations and understand its application in all branches of engineering.

CO 3. Learn how to interpolate the given set of values and understand the curve fitting for various polynomials. They will be able to compute numerical integration and differentiation, numerical solution of ordinary differential equations.

CO 4. Learn numerical solution of differential equations.

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Numerical Analysis
Course Code: FMAL-6333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory:80
3 1 0 | CA:20

Instructions for the Paper Setter:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

The students can use only Non-Programmable& Non-Storage Type Calculator.

Unit I

Error generation, error propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Method of false position, Newton-Raphson method, Generalized Newton-Raphson method, Iteration method, Muller's method, Rate of convergence of these methods.

Unit II

Solution of linear system of equation: Direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative methods: Jacobi's method, Gauss Seidel method. Finite Differences: Forward, Backward, Central, Divided differences, shift operator, relationship between the operators and detection of errors by use of difference operator. Interpolation with divided difference, Newton's formula, Lagrangian method.

Unit III

Finite difference interpolation, Gauss formula, Stirling formula, Bessel's formula, Error Estimation, Extrapolation. Numerical differentiation: Method based on interpolation. Numerical Integration: Trapezoidal rule, Simpson's rule, Weddle rule, Romberg integration, Gaussian integration method, Gaussian legendre integration. Double numerical integration.

Unit IV

Numerical solution of ordinary differential equations, Initial value problem, Taylor's method, Euler's methods, Picard's method, Milne's method, Runge-Kutta method, Predictor- Corrector's method.

Text Book:

M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, Delhi, Fifth edition, 2007 (Scope as in Chapters 2-6).

Master of Science (Mathematics) (FYIP)

Semester–VI
Session: 2025-26
Course Title: Special Functions
Course Code: FMAL-6334
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of Hyper geometric function, its integral form and Contiguity of Hyper geometric functions and solution of hyper geometric equation as a function of its parameters.

CO 2: Understand the concept of Bessel's Function and their properties like Recurrence Relations, Generating Function etc., modified Bessel Function and to recognize some of the Partial Differential Equations that can be solved by application of Bessel Functions.

CO 3: Understand the concept of Legendre's Function and their properties like Orthogonal Property, Recurrence Relations, Rodrigue's formula and Generating Function etc. and understand Hyper geometric forms of Legendre's function.

CO 4: Understand the concept of Hermite Polynomials, basic properties like Orthogonality, Rodrigue's formula etc. and its relation with $2F_0$.

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Special Functions
Course Code: FMAL-6334

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory:80

3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Hypergeometric functions, The function $F(a,b,c,z)$, Integral form, Evaluation of $F(a,b,c,1)$, The contiguous function relations, The Hypergeometric differential equation, solution of hypergeometric equation, $F(a,b,c,z)$ as a function of its parameters, Relation between z and 1-z, A quadratic transformation, A theorem due to Kummer.

Unit II

Bessel's functions of first and second kind, Bessel's differential equation, Recurrence relations, Generating functions, Bessel's integral, Modified Bessel functions, Neumann polynomials, Neumann series.

Unit III

Legendre's function $P_n(x)$, A generating function, Recurrence relation, Legendre differential equation, The Rodrigues formula, Bateman's generating function, Hypergeometric forms of $P_n(x)$ Laplace's first integral form, Orthogonality.

Unit IV

Hermite Polynomials, Recurrence relations, Rodrigues formula, Integrals, The Hermite polynomial as ${}_2F_0$, Orthogonality.

Text Book:

S. S Trivedi, Special functions, Pragati Prakashan, Meerut, XXI edition, 2021 (Scope as in chapters 3,4,5,6,7)

Reference Book:

M.D. Raisinghania, Ordinary and Partial Differential equations, S. Chand publication, New Delhi , 18th edition, 2013 (Scope as in chapters 9,10,11,12,14)

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Differential Geometry
Course Code: FMAL-6335
Course Outcomes

After passing this course, the students will be able to:

CO 1: Able to explain the concept of theory of space curve tangent, normal, binormal and rectifying plane.

CO 2: Able to understand contact between curves and surfaces, locus of centre of curvature, spherical curvature as well as calculate the curvature and torsion of curve

CO 3: Understand the concept of Spherical indicatrix, envelopes, and two fundamental forms,

CO 4: Understand tensor variables, metric tensor, contra-variant, covariant and mixed tensors & and able to apply tensors among mathematical tools for invariance and the reason why the tensor analysis is used and explain usefulness of the tensor analysis.

Master of Science (Mathematics) (FYIP)
Semester–VI
Session: 2025-26
Course Title: Differential Geometry
Course Code: FMAL-6335

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory:80

3 1 0 | CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

## Unit I

Curves in $R^3$: A simple arc, curves and their parametric representation, arc length, contact of curves, tangent line, osculating plane, principal normal, binormal, normal plane, rectifying plane.

## Unit II

Curvature and torsion, Serret-Fremet Formulae, Helics, Evolute and Involute of a parametric curve, Osculating circle and osculating sphere, spherical curves.

## Unit III

Surfaces in $R^3$: Implicit and Explicit forms of the equation of surface, two fundamental forms of a surface, Family of surfaces, Edge of regression, Envelops .

## Unit IV

Einstein's summation convention, Transformations of coordinates, Tensor's law for transformation, contravariant, covariant and mixed Tensors, addition, outer product, contraction, inner product and quotient law of tensors, metric Tensor and Riemannian metric.

Text Book:

G.S Malik, Differential Geometry, Pragati Prakashan, Meerut , IX edition , 2013 (Scope as in chapters 1-10)

Reference Books:

1. D Somasundaram, Differential Geometry: A first Course, Alpha Science International Limited, New Delhi, 2005 (Scope as in chapters 1,2)

2. C.E Weather burn, Differential Geometry, Cambridge University Press, Cambridge (Scope as in chapters 1,2,3,4)