

**St. Xavier's College (Autonomous), Palayamkottai**

**Department of Mathematics**

**Syllabus 2023**

Programme: B.Sc. Mathematics

Programme Code: UMT

**PROGRAMME OUTCOMES (POs) FOR UG PROGRAMMES**

Students of all Undergraduate Degree Programmes at the time of graduation will be able to attain the following at the institution level:

**PO1. Critical Thinking:** Acquire the knowledge in the respective field and take informed actions.

**PO2. Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

**PO3. Social Interaction:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

**PO4. Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

**PO5. Ethics:** Recognize different value systems and apply ethical principles and commit to professional ethics and responsibilities and norms of different value systems.

**PO6. Environment and Sustainability:** Demonstrate the issues of environmental contexts and sustainable development.

**PO7. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modeling to complex activities with an understanding of the limitations.

**PO8. Self-directed and Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of socio-technological changes

## **PROGRAM SPECIFIC OUTCOMES:**

Students of all Undergraduate Degree Programmes at the time of graduation will be able to attain the following at the department level:

**PSO1.** Domain Knowledge: Apply the knowledge of all courses for the solution of problems

**PSO2.** Problem Analysis: Identify, formulate, and analyze complex problems for reaching substantiated conclusions using the theories learned in all courses

**PSO3.** Design/Development of Solutions: Design solution for complex problems and design system components or procedures that can build the theories of different courses that may pave the way for the evaluation of the theories learned in different courses

**PSO4.** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

**PSO5.** Create an application: Integrate different procedures learned in all courses that may pave the way for the development of analytical thinking so that new procedures can be formulated

## B. Sc Mathematics Programme Pattern

Sem	Part	Status	Sub. Code	Title of the Paper	Hrs	Cdt
I	I	Lang	23UGTL11	General Tamil – I		
	I	Lang	23UGHL11	Hindi – I		
	I	Lang	23UGFL11	French – I	6	3
	II	Lang	23UGEL11	General English - I	6	3
	III	Core-T1	23UMTC11	Algebra and Trigonometry	4	4
	III	Core-T2	23UMTC12	Differential Calculus	4	4
	III	EC-T1	23UPHE11	Allied I : Physics Theory	4	3
	III	EC-P1	23UPHE12	Allied I : Physics Practical	2	2
	IV	SEC-1	23UMTN11	Numerical Ability- I (NME)	2	2
	IV	FC	23UHER11/ 23UHEE11	Foundation Course: Religion: Catholic Doctrine/Ethics	2	2
<b>Sub Total</b>					<b>30</b>	<b>23</b>
II	I	Lang	23UGTL21	General Tamil – II	6	3
	I	Lang	23UGHL21	Hindi – II		
	I	Lang	23UGFL21	French – II		
	II	Lang	23UGEL21	General English - II	6	3
	III	Core-T3	23UMTC21	Analytical Geometry	4	4
	III	Core-T4	23UMTC22	Integral Calculus	4	4
	III	EC-T2	23UPHE21	Allied II : Physics Theory	4	3
	III	EC-P2	23UPHE22	Allied II : Physics Practical	2	2
	IV	SEC-2	23UMTN21	Numerical Ability -II (NME)	2	2
	IV	SEC-3	23UHEI21	Integrated Personality Development	2	2
<b>Sub Total</b>					<b>30</b>	<b>23</b>
III	I	Lang	23UGTL31	General Tamil – III	6	3
	I	Lang	23UGHL31	Hindi – III		
	I	Lang	23UGFL31	French – III		
	II	Lang	23UGEL31	General English - III	6	3
	III	Core-T5	23UMTC31	Sequences and Series	5	5
	III	Core-T6	23UMTC32	Differential Equations, Laplace Transforms and Fourier Series	5	4
	III	EC-T3	23UMTE31	Allied III :Mathematical Statistics – I	4	4
	IV	SEC-4	23UHEL31	Life Issues and Entrepreneurial Skill Development	2	2
	IV	SEC-5	23UMTN31	Mathematics for Competitive Examinations - I (NME)	2	2
<b>Sub Total</b>					<b>30</b>	<b>23</b>
IV	I	Lang	23UGTL41	General Tamil - IV		
	I	Lang	23UGHL41	Hindi – IV		
	I	Lang	23UGFL41	French – IV	6	3
	II	Lang	23UGEL41	General English - IV	6	3
	III	Core-T7	23UMTC41	Real Analysis	6	5
	III	EC-T4	23UMTE41	Allied IV: Mathematical Statistics – II	6	4
	IV	SEC-6	23UMTN41	Mathematics for Competitive Examinations-II (NME)	2	2
	IV	SEC-7	23UMTS42	Vector Calculus and Applications	2	2
IV	EVS	23UEVS41	Environmental Studies	2	2	
<b>Sub Total</b>					<b>30</b>	<b>21</b>

V	III	Core-T8	23UMTC51	Abstract Algebra	6	5
	III	Core-T9	23UMTC52	Modern Analysis	6	4
	III	Core-T10	23UMTC53	Graph Theory	5	4
	III	Core-T11	23UMTC54	Programming in Python Theory	4	3
		Core-P3	23UMTC55	Programming in Python Practical	2	2
	III	EC-T5	23UMTE51	Linear Programming and Game Theory / Operations Research / Number Theory	5	4
	IV	VE	23UVEH51	Human Rights and Social Analysis	2	2
IV	Internship	23UMTI51	Internship	-	2	
<b>Sub Total</b>					<b>30</b>	<b>26</b>
VI	III	Core-T13	23UMTC61	Linear Algebra and Lattices	6	4
	III	Core-T14	23UMTC62	Complex Analysis	6	4
	III	Core-T15	23UMTC63	Mechanics	6	4
	III	Core-T16	23UMTC64	Project with viva voce	5	3
	III	EC-T6	23UMTE61	Numerical Methods / Astronomy /Discrete Mathematics/ Introduction to Machine Learning Theory&Practical/ Introduction to Data Science Theory&Practical	5	3
	IV	SEC-8	23UMTS61	Techniques in Reasoning	2	2
	V	Extension Activities		STAND (Student Training and Action for Neighbourhood Development)	-	1
<b>Sub Total</b>					<b>30</b>	<b>21</b>
<b>Additional Compulsory Courses</b>						
I UG	Add On	23UMTAO1	Mathematical Quotient		2	
II UG	Value Added (Any one)	23UMTCC1/ 23UMTCC2	Mathematical Aptitude / Training for JAM Examination		2	
III UG	Extra Credit Courses (Any one)	23UMTEC1	R Programming		2	
		23UMTEC2	Data Analytics			
		23UMTEC3	Statistical Methods			
		23UMTEC4	Quantitative Aptitude			
		23UMTEC5	History of Mathematics			
<b>Total</b>				<b>180</b>	<b>146</b>	

#### Extra Credit Courses for other major students

Sem.	Part	Course Code	Title of the Paper	Credits
II	V	23UMTEC6	Set Theory	2
III	V	23UMTEC7	Analytical Geometry of Two Dimensions	2
IV	V	23UMTEC8	Python	2
V	V	23UMTEC9	Classical Algebra	2
VI	V	23UMTEC10	Differentiation and Integration	2

**LEARNING OBJECTIVES: கற்றலின் நோக்கங்கள்**

1. முதலாமாண்டு பட்ட வகுப்பு மாணவர்களுக்குத் தமிழ்மொழி இலக்கியங்களை அறிமுகம் செய்தல்.
2. தற்கால இலக்கியப் போக்குகளையும் இலக்கணங்களையும் மாணவர் அறியுமாறு செய்து அவர்களின் படைப்பாற்றலைத் தூண்டுதல்.
3. தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.
4. மொழித்திறன்களை மாணவர்கள் அறிந்துகொள்ள தூண்டுதல்.
5. நவீன இலக்கிய வகைமைகளை அறிமுகம் செய்தல்.
6. சமூகச்சிந்தனைகளை உருவாக்க இலக்கியப்பாடுபொருள் காரணமாய் உள்ளது என்பதை அறியச் செய்தல்.

**அலகு1: மரபுக்கவிதை**

- |                   |  |
|-------------------|--|
| 1. பெ. சுந்தரனார் | - தமிழ்த் தெய்வவணக்கம்                   |
| 2. பாரதிதாசன்     | - சிறுத்தையே வெளியே வா                   |
| 3. கவிமணி         | - புத்தரும் சிறுவனும்                    |
| 4. முடியரசன்      | - மொழி உணர்ச்சி                          |
| 5. கண்ணதாசன்      | - ஆட்டனத்தி ஆதிமந்தி (ஆதிமந்தி புலம்பல்) |
| 6. சுரதா          | - துறைமுகம் (வினாத்தாள்)                 |
| 7. தமிழ் ஒளி      | - கடல்                                   |

**அலகு2: புதுக்கவிதை**

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|-----------------------|--|
| 1. அப்துல் ரகுமான்    | - வீட்டுக்கொரு மரம் வளர்ப்போம்               |
| 2. ஈரோடு தமிழன்பன்    | - சென்றியூ கவிதைகள் (ஏதேனும் ஐந்து கவிதைகள்) |
| 3. வைரமுத்து          | - பிற்சேர்க்கை                               |
| 4. மு.மேத்தா          | - வாழைமரத்தின் சபதம்                         |
| 5. அறிவுமதி           | - வள்ளுவம் பத்து                             |
| 6. நா. முத்துக்குமார் | - ஆனந்த யாழை மீட்டுகிறாய்                    |
| 7. சுகிர்தராணி        | - சபிக்கப்பட்ட முத்தம்                       |
| 8. இளம்பிறை           | - நீ எழுத மறுக்கும் எனது அழகு                |

**அலகு3: சிறுகதைகள்**

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| 1. வாய்ச்சொற்கள்   | - ஜெயகாந்தன் (மாலை மயக்கம் தொகுப்பு) |
| 2. கடிதம்  | - புதுமைப்பித்தன்                    |
| 3. கரு   | - உமா மகேஸ்வரி                       |
| 4. முள்முடி  | - தி. ஜானகிராமன்                     |
| 5. சிதறல்கள்   | - விழி. பா. இதயவேந்தன்               |
| 6. காகிதஉறவு   | - சு. சமுத்திரம்                     |
| 7. வீட்டின் மூலையில் சமையலறை- அம்பை  |                                      |
| 8. (மொழிப்பெயர்ப்புக் கதை) நாயக்காரர் சீமாட்டி - ஒரு குறும்புக்காரர் சிறுவன் |                                      |

#### அலகு4: பாடம் சார்ந்த இலக்கிய வரலாறு

#### அலகு5 : மொழித்திறன் போட்டித் தேர்வு

1. பொருள் பொதிந்த சொற்றொடர் அமைத்தல்
2. ஓர் எழுத்து ஒரு மொழி
3. வேற்றுமை உருபுகள்
4. திணை, பால், எண், இடம்
5. கலைச்சொல்லாக்கம், மொழிபெயர்ப்பு

#### COURSE OUTCOMES: பயன்கள்

இப்பாடங்களைக் கற்பதால் மாணவர் பின்வரும் பயன்களைப் பெறுவர்.

CO1- பாரதியார் காலந்தொட்டு தற்காலப் புதுக்கவிதைகள் வரை கவிதையிலக்கியம் அறிமுகப்படுத்தப்படுவதால் படைப்பாற்றல் திறன் பெறுதல். (K1,K2)

CO2- புதுக்கவிதை வரலாற்றினை அறிந்துகொள்வர். (K2)

CO3- இக்கால இலக்கிய வகையினைக் கற்பதன் மூலம் படைப்பாக்கத் திறனைப் பெறுதல். (K4)

CO4- மொழி அறிவோடு சிந்தனைத் திறன் அதிகரித்தல். (K3)

CO5- தமிழ்மொழியைப் பிழையின்றி எழுதவும், புதிய கலைச் சொற்களை உருவாக்கவும் அறிந்துகொள்வர். (K4)

CO6- காலந்தோறும் சமூகச் சிந்தனைகள் மாறுவதை இலக்கிய வரலாற்றின் மூலம் அறிந்து கொள்ளுதல். (K6)

#### TEXT BOOKS (பாடநூல்கள்)

1. தமிழ்த்துறை வெளியீடு - தூய சவேரியார் தன்னாட்சிக் கல்லூரி, பாளையங்கோட்டை.
2. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு- எ.பி. பாக்கியமேரி

#### REFERENCE BOOKS (பார்வை நூல்கள்)

- தமிழ் இலக்கிய வரலாறு - சிற்.பி. பாலசுப்பிரமணியன்
- புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு – தமிழண்ணல்
- தமிழ் இலக்கிய வரலாறு – சேதுராமன்

#### WEB SOURCES (இணையதளங்கள்)

- Tamil Heritage Foundation- [www.tamilheritage.org](http://www.tamilheritage.org) <<http://www.tamilheritage.org>>
- Tamil virtual University Library- [www.tamilvu.org/library](http://www.tamilvu.org/library) <http://www.virtualvu.org/library>
- Project Madurai - [www.projectmadurai.org](http://www.projectmadurai.org).
- Chennai Library- [www.chennailibrary.com](http://www.chennailibrary.com) <<http://www.chennailibrary.com>>.
- Tamil Universal Digital Library- [www.ulib.prg](http://www.ulib.prg) <<http://www.ulib.prg>>.
- Tamil E-Books Downloads- [tamilebooksdownloads.blogspot.com](http://tamilebooksdownloads.blogspot.com)
- Tamil Books on line- [books.tamilcube.com](http://books.tamilcube.com)
- Catalogue of the Tamil books in the Library of British Congress [archive.org](http://archive.org)
- Tamil novels on line - [books.tamilcube.com](http://books.tamilcube.com)

பருவம்: 2	தாள்:மொழிப்பாடம்	Hrs: 6	Credits: 3
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**LEARNING OBJECTIVES: கற்றலின் நோக்கங்கள்**

1. சமய இலக்கியங்களையும் சிற்றிலக்கியங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
2. மொழித்திறனையும் சிறுகதை இலக்கிய வடிவத்தையும் மாணவர்களுக்கு உணர்த்துதல்.
3. தமிழ் இலக்கிய வரிசையில் சமய இலக்கியங்களின் முக்கியத்துவத்தை உணர்த்துதல்.
4. தமிழ் இலக்கிய வரிசையில் சிற்றிலக்கியங்களின் முக்கியத்துவத்தை அறிமுகம் செய்தல்.
5. தமிழ் இலக்கிய வளமைக்குப் பல்சமயங்கள் ஆற்றிய பங்கினை உணரச் செய்தல்.
6. சமய, சிற்றிலக்கியங்களின் இடத்தைத் தமிழ் இலக்கிய வரலாற்றின் வழி அறியச் செய்தல்.

**அலகு 1:**

- திருநாவுக்கரசர் - தேவாரம் - நாமார்க்கும் குடியல்லோம் எனத் தொடங்கும் பதிகம் (10 பாடல்கள்)
- ஆண்டாள் - திருப்பாவை (முதல் 20 பாசரம்)

**அலகு 2 :**

- வள்ளலார் - அருள் விளக்கமாலை (முதல் 10 பாடல்கள்)
- எச்.ஏ.கிருட்டிணப்பிள்ளை - இரட்சணியமனோகரம் - பால்ய பிராத்தனை
- குணங்குடி மஸ்தான் சாகிபு - பராபரக்கண்ணி (முதல் 10 கண்ணி)

**அலகு 3:**

- தமிழ் விடுதாது (முதல் 20 கண்ணி)
- திருக்குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறுதல்
- முக்கூடற்பள்ளு - நாட்டு வளம்

**அலகு 4: பாடம் தழுவிய இலக்கிய வரலாறு**

(பல்லவர் காலம், நாயக்கர் காலம்)

**அலகு 5 : மொழித்திறன் - போட்டித் தேர்வுத்திறன்**

1. தொடர் வகைகள்
2. மரபுத்தொடர், பழமொழிகள்
3. பிறமொழிச் சொற்களைக் களைதல்
4. வழுச்சொற்கள் நீக்குதல்
5. இலக்கணக் குறிப்பு அறிதல்.

## COURSE OUTCOMES - பயன்கள்

- CO1– பக்தி இலக்கியங்களைக் கற்பதன் மூலம் பக்தி நெறியினையும், சமய நல்லிணக்கத்தையும் தெரிந்து பின்பற்றுவர். (K1,K2)
- CO2– சிற்றிலக்கியங்களின் வழி இலக்கியச் சுவையினையும் பண்பாட்டு அறிவினையும் பெறுவர். (K2)
- CO3– பட்டப்படிப்பினைப் படிக்கும்போதே பெரும்பான்மையான தமிழ் இலக்கியங்கள் குறித்த அறிவினைப் பெறுவர். (K4)
- CO4– தமிழ்ச் சமூகப் பண்பாட்டு வரலாற்றினை இலக்கியங்கள் வாயிலாக அறிவர். (K3)
- CO5– போட்டித் தேர்வுகளில் வெற்றிப் பெறுவதற்குத் தமிழ்ப்பாடத்தினை பயன் கொள்ளும் வகையில் ஏற்ற பயிற்சி பெறுவர். (K4)
- CO6– பல்சமய இலக்கியங்களை அறிவதன் மூலம் பல்சமய உரையாடல்களின் முக்கியத்துவத்தை அறிவர். (K3)

## TEXT BOOKS (பாட நூல்கள்)

1. தமிழ்த்துறை வெளியீடு, தூய சுவேரியார் தன்னாட்சிக் கல்லூரி, பாளையங்கோட்டை.
2. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு– எ.பி. பாக்கியமேரி

## REFERENCE BOOKS (பார்வை நூல்கள்)

- தமிழ் இலக்கிய வரலாறு - சிற்பி. பாலசுப்பிரமணியன்
- புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு – தமிழண்ணல்
- தமிழ் இலக்கிய வரலாறு – சி.சேதுராமன்

## WEB SOURCES (இணையதளங்கள்)

- Tamil Heritage Foundation- [www.tamilheritage.org](http://www.tamilheritage.org) <<http://www.tamilheritage.org>>
- Tamil virtual University Library- [www.tamilvu.org/ library](http://www.tamilvu.org/library) <http://www.virtualvu.org/library>
- Project Madurai - [www.projectmadurai.org](http://www.projectmadurai.org).
- Chennai Library- [www.chennailibrary.com](http://www.chennailibrary.com) <<http://www.chennailibrary.com>>.
- Tamil Universal Digital Library- [www.ulib.prg](http://www.ulib.prg) <<http://www.ulib.prg>>.
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- Tamil Books on line- [books.tamil cube.com](http://books.tamilcube.com)
- Catalogue of the Tamil books in the Library of British Congress [archive.org](http://archive.org)
- Tamil novels on line - [books.tamilcube.com](http://books.tamilcube.com)



பருவம்: 3

தாள்: மொழிப்பாடம்

Hrs: 6

Credits: 3

**Learning objectives: கற்றலின் நோக்கங்கள்**

1. காலந்தோறும் எழுந்த காப்பியங்களின் போக்கையும், புதினத்தின் இலக்கிய வடிவத்தையும் மாணவர்கள் உணருமாறு செய்தல்
2. காப்பியம், புதினம், ஆகிய படைப்பியல் வகைகளைப் பற்றிய பரந்து பட்டபுலமையைப் பெருக்குதல்.
3. தமிழ் இலக்கியங்களின் உள்ளடக்கம், வெளியீட்டுநெறி, படைப்பியல் கொள்கை ஆகியவற்றை அறியச் செய்தல்.
4. இலக்கியக் கொள்கைகளின் அடிப்படையில் இலக்கியங்களைத் திறனாய்வுச் செய்யப் பயிற்சி அளித்தல்.
5. படைப்புத் துறையிலும் ஊடகத் துறையிலும் கல்விப் புலத்திலும் அயல்நாடுகளிலும் வேலைவாய்ப்பினைப் பெறுதற்குத் துணைசெய்தல்.
6. மதிப்புரை, திறனாய்வு அறிமுகப்படுத்துவதன் மூலம் சிறந்த திறனாய்வுகளை அடையாளம் காணுதல்

**அலகு: 1**

சிலப்பதிகாரம் - வழக்குரைகாதை, மணிமேகலை - ஆதிரை பிச்சையிட்ட காதை, சீவகசிந்தாமணி - பூமகள் இலம்பகம், வளையாபதி

**அலகு: 2**

பெரியபுராணம் - பூசலார் புராணம், கம்பராமாயணம் - மந்தரை சூழ்ச்சிப் படலம், வில்லிபாரதம் - மற்போர் சருக்கம், சீறாப்புராணம் - புலி வசனித்த படலம்.

**அலகு: 3**

வஞ்சிமாநகரம் வரலாற்றுப் புதினம் - நா.பார்த்தசாரதி

**அலகு: 4**

பாடம் தழுவிய இலக்கிய வரலாறு

**அலகு: 5**

மொழித்திறன்

1. நூல் மதிப்புரை
2. திறனாய்வுசெய்தல்
3. கடிதம் வரைதல்
4. விண்ணப்பம் எழுதுதல்

**Course outcomes: பயன்கள்**

- CO1 - காப்பியங்களின் வழி வாழ்வியல் சிந்தனையைப் பெறுதல். (K1,K2)
- CO2 - காப்பியங்கள் அறிமுகப் படுத்தப்படுவதால் தமிழ் மொழியின் உயர்வையும், சிறப்பையும் உணர்தல். (K2)
- CO3 - தமிழ் புதினங்கள் வழி சமகாலப் படைப்புகளின் வாழ்வியல் சிந்தனைகளை அறிதல் (K4)
- CO4 - நாவல் இலக்கியம் அறிமுகப்படுத்தப்படுவதால் சிந்தனை ஆற்றல், படைப்பாற்றல், கற்பனைத் திறன் வளர்தல் (K3)
- CO5 - தமிழ் இலக்கியம் சார்ந்தபோட்டித் தேர்வுகளை எதிர்கொள்ளும் ஆற்றல் பெறுதல் (K4)
- CO6 - கடிதம், விண்ணப்பம் எழுதும் முறைகளை அறிதல் (K6)

பாடநூல்கள் :

தமிழ்த்துறை வெளியீடு  
பார்வை நூல்கள்  
1. தமிழ் இலக்கியவரலாறு- சிற்பிபாலசுப்பிரமணியன்

இணையதளம்

1. Tamil Heritage Foundation – [www.tamilheritage.org](http://www.tamilheritage.org)<<http://www.tamilheritage.org>>.
2. Tamil Virtual University Library – [www.tamilvu.org/library](http://www.tamilvu.org/library)<http://www.virtualvu.org/library>
3. Project Madurai – [www.projectmadurai.org](http://www.projectmadurai.org)
4. Chennai Library – [www.chennailibrary.com](http://www.chennailibrary.com)<<http://www.chennailibrary.com>>
5. Tamil Universal Library- [www.ulib.prg](http://www.ulib.prg)<<http://www.ulib.prg>>
6. Tamil E-books downloads – [tamilbooksdownloads.blogspot.com](http://tamilbooksdownloads.blogspot.com)
7. Tamil Books online – [books.tamilcube.com](http://books.tamilcube.com)
8. Catalogue of the Tamil Books in the library of British congress [archive.org](http://archive.org)
9. Tamil novels.online – [books.tamil.cube.com](http://books.tamil.cube.com)

**Learning objectives: கற்றலின் நோக்கங்கள்**

1. இலக்கியங்களின் சிறப்பினை உணர்த்துதல்
2. சங்க இலக்கியத்தின் மும் வாழ்வியல் நெறிகள் உணர்தல்
3. தமிழ் இலக்கியங்களின் உள்ளடக்கம், வெளியீட்டுநெறி, படைப்பியல் கொள்கை ஆகியவற்றை அறியச் செய்தல்.
4. அகத்திணை, புறத்திணை இலக்கணங்களை மாணவர்கள் அறியச் செய்தல்
5. மொழிபெயர்ப்புத் திறனை வளர்த்தல்
6. நாடக இலக்கியங்களின் அமைப்பு முறையை அறிதல்

**அலகு: 1**

நற்றிணை 10, 14, 16, குறுந்தொகை - 16, 17, 19, 20, 25, 29, 38, 44, கலித்தொகை - 38, 51, அகநானூறு - 15, 33, 55, புறநானூறு - 37, 86, 112, பரிபாடல் - 55

**அலகு: 2**

நெடுநல்வாடை- நக்கீரர்

**அலகு: 3**

சபாபதிநாடகம் - பம்மல் சம்பந்த முதலியார்

**அலகு: 4**

பாடம் தழுவிய இலக்கியவரலாறு

**அலகு: 5**

மொழித்திறன்

1. மொழிபெயர்ப்புகலைச்சொற்கள்
2. கொடுக்கப்பட்டுள்ள ஆங்கிலப் பகுதியைத் தமிழில் மொழிபெயர்த்தல்
3. அலுவலகக் கடிதம்- தமிழில் மொழிபெயர்த்தல்

**Course outcomes: பயன்கள்**

- CO1 – சங்க இலக்கியங்களில் காணப்படும் வாழ்வியல் சிந்தனைகளை அறிதல் (K1,K2)  
CO2 – தமிழின் தொன்மையையும் செம்மொழித் தன்மையையும் உணர்தல் (K2)  
CO3 – நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும் கலைத்தன்மையையும் வளர்த்தல் (K4)  
CO4 – நாடக இலக்கியம் அறிமுகப்படுத்தப்படுவதால் சிந்தனை ஆற்றல், படைப்பாற்றல், கற்பனைத் திறன் வளர்த்தல் (K4)  
CO5 – தமிழிலிருந்து அலுவலகக் கடிதங்களை மொழிபெயர்க்கும் அறிவைபெறுதல் (K3)  
CO6 - மொழி அறிவோடு வேலைவாய்ப்பினையும் பெறுதல். (K4)

பாடநூல்கள் :

தமிழ்த்துறை வெளியீடு

பார்வை நூல்கள்

2. தமிழ் இலக்கிய வரலாறு- சிறப்பிபாலசுப்பிரமணியன்

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5. Tamil Universal Library- [www.ulib.pig7](http://www.ulib.pig7)<<http://www.ulib.pig7>>
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DEPARTMENT OF ENGLISH

UG – PART II - GENERAL ENGLISH

(The Seven-Tier Pattern recommended by UGC Curriculum Development Centre and Identified as Best Practice by NAAC)

	<b>Stream A</b> (For learners of high entry level proficiency)	<b>Stream B</b> (For learners of average entry level proficiency)	<b>Stream C</b> (For learners of low entry level proficiency)
<b>Courses in Semester I</b>	<b>IV</b> <b>23UGEL14</b>	<b>III</b> <b>23UGEL13</b>	<b>I</b> <b>23UGEL11</b>
<b>Courses in Semester II</b>	<b>V</b> <b>23UGEL25</b>	<b>IV</b> <b>23UGEL24</b>	<b>II</b> <b>23UGEL22</b>
<b>Courses in Semester III</b>	<b>VI</b> <b>23UGEL36</b>	<b>V</b> <b>23UGEL35</b>	<b>III</b> <b>23UGEL33</b>
<b>Courses in Semester IV</b>	<b>VII</b> <b>23UGEL47</b>	<b>VI</b> <b>23UGEL46</b>	<b>IV</b> <b>23UGEL44</b>

**GENERAL COURSE OUTCOMES**

- CO1 Acquire the four language skills (Listening, Speaking, Reading and Writing)
- CO2 Develop the skill of independent reading and interpreting of graded texts
- CO3 Expand and consolidate active and passive vocabulary
- CO4 Acquire the skills needed to participate in a conversation that builds knowledge collaboratively
- CO5 Acquire a clear understanding of English Grammar to facilitate accuracy of communication
- CO6 Develop the skills of formal written communication to be used in academic and career related contexts

**TEXTS**

- Course I - *Spotlight I*
- Course II - *Spotlight II*
- Course III - *Spotlight III*
- Course IV - *Spotlight IV*
- Course V - *Spotlight V*
- Course VI - *Spotlight VI*
- Course VII - William Shakespeare's *Julius Caesar* & Charles Dickens' *Oliver Twist*
- All Courses - *Active English Grammar and Composition* by the Board of Editors

## EXTERNAL EXAMINATION

- ❖ External Examination has two components.  
1) Written Examination and 2) Viva Voce
- ❖ A three-hour written examination will be conducted for 100 marks for all General English papers and the scores will be converted to 40 marks, with a pass minimum of 16 marks
- ❖ At the end of every semester, **Spoken English Viva Voce** will be conducted for all the students for 100 marks (four components) and the scores will be converted to 10 marks, with a required pass minimum of 4 marks
- ❖ To pass in any General English paper, a student must secure the pass minimum of 40 out of 100

Distribution of marks:	<b>Written Exam</b> (100 marks)	Converted to 40 marks
	<b>Viva voce</b> (100 marks)	Converted to 10 marks
	<b>TOTAL (40+10)</b>	<b>50 marks</b>

## INTERNAL ASSESSMENT

- ❖ Two Internal Examinations shall be conducted for 50 marks each along with the Continuous Internal Assessments for the Core and Allied courses.
- ❖ The internal assessment for the courses may include assignments, seminars, projects, tests, viva (any oral presentation), communication activities etc., focusing on skill development or / and the course content

**GENERAL ENGLISH  
COURSE – I**

**Hours: 6**

**Course Code: 23UGEL11**

**Credits: 3**

**LEARNING OUTCOMES**

- LO1** To provide an ambience to acquire the basic language skills, listening, speaking, reading and writing  
**LO2** To make the learners learn the basic elements of grammar  
**LO3** To enable them to involve in basic communicative activities  
**LO4** To develop basic vocabulary  
**LO5** To help the learners comprehend and respond in English  
**LO6** To build confidence in using English to communicate

UNIT	TOPICS	
<b>I</b>	<b>POETRY</b> Maya Angelou Hilaire Belloc	“Poor Girl” “The Justice of Peace”
<b>II</b>	<b>PROSE</b> A. P. J. Abdul Kalam Madhavan Kutty	“My Early Days” “I Won’t Let Him Go!”
<b>III</b>	<b>SHORT STORIES</b> Oscar Wilde Mulk Raj Anand	“The Selfish Giant” “The Lost Child”
<b>IV</b>	<b>LANGUAGE COMPETENCY</b> 1. Use of Verbs: Verb Grid (Positive, Negative & Question), Regular Verbs, Irregular Verbs & Modals 2. Tenses: Active Voice Tenses & Passive Voice Tenses 3. Use of Nouns: Forms of Personal Pronouns, Use of Nouns as Subject, Object, Complement and Object of the Preposition 4. Sentence Patterns: SV, SVO, SVC, SVA, SVOA, SVIODO 5. Punctuation and Capitalisation 6. Reading Comprehension (5 Anecdotes and 5 Wisdom Stories)	
<b>V</b>	<b>SPOKEN ENGLISH</b> 1. Reading Aloud (From the text)      2. Introducing oneself 3. Describing a place (With hints)      4. Describing a picture(With hints)	

**COURSE OUTCOMES**

- CO1** Use grammatical structures in meaningful constructions  
**CO2** Use oral communication for day-to-day activities  
**CO3** Use simple sentences for oral and written communication  
**CO4** Use punctuation and capitalisation accurately  
**CO5** Comprehend what they listen to, and respond to it at the primary level  
**CO6** Read and appreciate simple stories and anecdotes

## TEXTBOOKS

1. Board of Editors. *Spotlight I*. India: Ponnasai Publishers & Distributors, 2015.
2. *Oxford Elementary Learner's Dictionary*. Ed. Angela Crawley. Phonetics Ed. Michael Ashby. United Kingdom: Oxford University Press, 2021.
3. Board of Editors. *Active English Grammar and Composition*. India: Trinity Press, 2022.

## REFERENCE

- Bhatnagar, R. P. ,*English for Competitive Examinations*, India: Trinity Press, 2017.
- Joseph K. V. , *A Textbook of English Grammar & Usage*, India: McGraw Hill Education 2015.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	3 Short essays (200 words each) out of 6 from Units I, II & III (3X10)	30
II	5 Match the following from Units I, II & III	05
III	5 Stating True or False from Units I, II & III	05
IV	Verb Grid (Positive, Negative & Question)	20
V	Tense Grid (Active & Passive)	10
VI	Noun as subject, object, complement & object of the preposition	10
VII	Sentence pattern	10
VIII	Punctuation & Capitalization	05
IX	Reading comprehension	05
	<b>Total</b>	<b>100</b>

## GENERAL ENGLISH

### COURSE – II

Hours: 6

Course Code: 23UGEL22

Credits: 3

#### LEARNING OUTCOMES

- LO1 To provide an ambience to acquire the basic language skills, listening, speaking, reading and writing
- LO2 To make the learners frame questions and answers
- LO3 To enable them to involve in basic communicative activities
- LO4 To develop a comprehensible use of adjectives and adverbs
- LO5 To help the learners comprehend and respond in English
- LO6 To develop oral communication for day-to-day activities

UNIT	TOPICS	
I	<b>POETRY</b> Rabindranath Tagore Gieve Patel	“Leave this Chanting and Singing” “ On Killing a Tree”
II	<b>PROSE</b> Leslie W. Leavitt Sister Nivedita	“Mahatma Gandhi” “The Judgement Seat of Vikramaditya”
III	<b>SHORT STORIES</b> O. Henry Stephen Leacock	“After Twenty Years” “With the Photographer”
IV	<b>LANGUAGE COMPETENCY</b> 1. Use of Adjectives      2. Use of Adverbs 3. Use of Conditional ‘If’ (Probable & Improbable Conditions) 4. Use of ‘who’, ‘which’, ‘where’ & ‘that’ in combining sentences 5. Framing questions – ‘Wh -’ & ‘Yes’ / ‘No’ Questions 6. Prefixes and Suffixes 7. Developing Hints into a Paragraph	
V	<b>SPOKEN ENGLISH</b> 1. Reading Aloud (from the Prescribed Text)    2. Introducing Others 3. Describing a Personality (from Hints)      4. Narrating a Story(from Hints)	

#### COURSE OUTCOMES

- CO1 Use grammatical structures in meaningful contexts
- CO2 Use oral communication for day-to-day activities
- CO3 Use simple sentences for oral and written communication
- CO4 Use enhanced vocabulary
- CO5 Comprehend and respond to what they listen to at the secondary level
- CO6 Read and appreciate simple pieces of fiction and non-fiction

#### TEXTBOOKS

1. Board of Editors. *Spotlight II*. India: Ponnasai Publishers & Distributors, 2015.



2. *Oxford Elementary Learner's Dictionary*. Ed. Angela Crawley. Phonetics Ed. Michael Ashby. United Kingdom: Oxford University Press, 2021.
3. Board of Editors. *Active English Grammar and Composition*. India: Trinity Press, 2022.

## REFERENCE

- Bhatnagar, R. P., *English for Competitive Examinations*. India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage*, India: McGraw Hill Education, 2015.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	3 Short Essays from Unit I, II and III	30
II	5 True or False ( Units I, II and III)	05
III	5 Match the Following (Unit I, II and III)	05
IV	Adding appropriate adjectives	10
V	Adding appropriate adverbs	10
VI	Framing Probable & Improbable Conditional Sentences	10
VII	Combining Sentences with 'who', 'where', 'which' & 'that'	10
VIII	Framing 'Wh' & 'Yes/No' Qns.	10
IX	Prefixes & Suffixes	05
X	Developing Hints to a Paragraph (100 words)	05
	<b>Total</b>	<b>100</b>

## GENERAL ENGLISH

### COURSE - III

**Hours: 6**

**Course Code: 23UGEL13, 23UGEL 33**

**Credits: 3**

#### LEARNING OUTCOMES

- LO1** To involve the learners in reading and interpreting English in poetry and prose (Fiction and Non-fiction)
- LO2** To enable learners to write about prescribed literature
- LO3** To help learners develop vocabulary register
- LO4** To help learners learn the appropriate use of articles, prepositions and adverbs
- LO5** To facilitate in learners, the ability to create a narration based on hints
- LO6** To build confidence in the learners to speak English for specific purposes

UNIT	TOPICS	
<b>I</b>	<b>POETRY</b> William Shakespeare P. B. Shelley Oliver Goldsmith	“All the World’s a Stage” “Ozymandias” “The Village Schoolmaster”
<b>II</b>	<b>SHORT STORIES</b> A. J. Cronin Stephen Leacock Ernest Hemingway	“Two Gentlemen of Verona” “The Conjuror’s Revenge” “A Day’s Wait”
<b>III</b>	<b>PROSE &amp; SHORT STORIES</b> C. L. N. Prakash O. Henry Natsume Soseki	“Rethink Your Thinking” “The Gift of the Magi” “I am a Cat”
<b>IV</b>	<b>LANGUAGE COMPETENCY</b> 1. Homonyms, Homophones, Homographs    2. Articles 3. Prepositions                                    4. Adverbs 5. Constructing a story using hints	
<b>V</b>	<b>SPOKEN ENGLISH</b> 1. Reading aloud                                    3. Describing a picture 2. Describing a process                            4. Personal Conversation (Habits, Hobbies, Future Plan)	

#### COURSE OUTCOMES

- CO1** Read and understand English in poetry and prose (Fiction and Non-Fiction)
- CO2** Write coherent essays about prescribed literature
- CO3** Use words from acquired vocabulary register
- CO4** Use articles, prepositions and adverbs appropriately
- CO5** Create a narration from hints

**CO6** Speak English confidently in a descriptive as well as expository style

**TEXTBOOKS**

1. Board of Editors. *Spotlight III*, India: Ponnasai Publishers & Distributors, 2015.
2. Board of Editors. *Active English Grammar and Composition*. India: Trinity Press, 2022.

**REFERENCE**

- Bhatnagar, R. P. *English for Competitive Examinations*. India: Trinity Press, 2017.
- Joseph. K. V, *A Textbook of English Grammar & Usage*, India:McGraw Hill Education, 2015
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

<b>S. No.</b>	<b>QUESTION PATTERN</b>	<b>Marks</b>
I	1 Short Essay (200 words) out of 2 from Unit I	10
II	1 Essay (300 words) out of 2 from Unit II	15
III	1 Essay (300 words) out of 2 from Unit III	15
IV	5 passages with 2 Qns. each (from Units I,II &III)	10
V	Homonyms, Homophones, Homographs	10
VI	Articles	10
VII	Prepositions	10
VIII	Adverbs	10
IX	Constructing a story	10
	<b>Total</b>	<b>100</b>



- CO3** Use the various tense forms accurately with proper subject - verb agreement  
**CO4** Write descriptive paragraphs with unity of sense  
**CO5** Identify common errors in the usage of Tenses and Concord  
**CO6** Speak English fluently with confidence in an expository as well as analytical style

**TEXTBOOKS**

1. Board of Editors. *Spotlight IV*. India: Ponnasai Publishers & Distributors, 2015.
2. Board of Editors. *Active English Grammar and Composition*. India: Trinity Press, 2022.

**REFERENCE**

- Bhatnagar, R. P. *English for Competitive Examinations*. India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage*, India: McGraw Hill Education, 2015
- Sinha, R. P. *Current English Grammar and Usage with Composition*, India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	1 Short Essay (200 words) out of 2 from Unit I	10
II	1 Essay (300 words) out of 2 from Unit II	15
III	1 Essay (300 words) out of 2 from Unit III	15
IV	5 passages with 2 Qns. each (from Units I, II & III)	10
V	Tenses	10
VI	Concord	10
VII	Describing a thing / a place / an event	10
VIII	Spotting Errors	10
IX	Letter Writing	10
	<b>Total</b>	<b>100</b>

**GENERAL ENGLISH**

**COURSE – V**

<b>Hours: 6</b>	<b>Course Code: 23UGEL25, 23UGEL35</b>	<b>Credits: 3</b>
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**LEARNING OUTCOMES**

- LO1** To introduce learners to intermediate level of English through prescribed literature
- LO2** To make learners read, interpret and write about prescribed pieces of literature
- LO3** To make learners learn complex language structures and appropriate use of conjunctions
- LO4** To help learners become familiar with the accurate use of language with an awareness of common errors in language use
- LO5** To make learners understand the logical sequence of ideas within a paragraph
- LO6** To make learners speak English fluently with confidence and accuracy for specific purposes

UNIT	TOPICS	
<b>I</b>	<b>POETRY</b> William Wordsworth Robert Frost Mina Assadi H.W. Longfellow Philip Larkin	“The Solitary Reaper” “The Road Not Taken” “A Ring to Me Is Bondage” “A Slave’s Dream” “Next Please”
<b>II</b>	<b>PROSE, DRAMA AND SHORT STORY</b>	
	Dr. Radhakrishnan Collins & Lapiere Oscar Wilde Somerset Maugham A. A. Milne	“Humanities Vs Sciences” “The Second Crucifixion” “The Model Millionaire” “The Ant and the Grasshopper” “The Boy Comes Home”
<b>III</b>	<b>LANGUAGE COMPETENCY (Grammar &amp; Vocabulary)</b> 1. Words often confused 2. Synonyms and Antonyms 3. Synthesis and Transformation of Sentences (Simple, Compound & Complex) 4. Conjunctions 5. Active - Passive Voice	
<b>IV</b>	<b>LANGUAGE COMPETENCY (Composition)</b> 1. Expansion of Ideas / Proverbs 2. Sentence Arrangement 3. Dialogue Writing	
<b>V</b>	<b>SPOKEN ENGLISH</b> 1. Reading and Interpreting 2. Turncoat 3. Expand a Proverb 4. Issue Based Conversation	

## COURSE OUTCOMES

- CO1** Read, interpret and analyse poetic English to understand open possibility of inferences
- CO2** Write logically planned essays to address specific questions concerning prescribed literature
- CO3** Understand the forms and structural differences in different types of sentences and their specific purposes
- CO4** Use complex language structures with appropriate conjunctions
- CO5** Use vocabulary actively with an awareness of homonyms, homophones, synonyms and antonyms
- CO6** Use Spoken English fluently with confidence and accuracy for specific purposes such as analytical, argumentative and expository talks

## TEXT BOOKS

1. Board of Editors. *Spotlight V*, India:Ponnasai Publishers & Distributors, 2015.
2. Board of Editors. *Active English Grammar and Composition*. India:Trinity Press, 2022.

## REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations*, India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage*, India: McGraw Hill Education, 2015
- Sinha, R. P. *Current English Grammar and Usage with Composition*, India: Oxford University Press, 2018

S. No.	QUESTION PATTERN	Marks
I	1 Short Essay (200 words) out of 2 from Unit I	10
II	1 Essay (300 words) out of 2 from Unit II	15
III	5 passages with 2 Qns. each (from Units I, II & III)	10
IV	Vocabulary	15
V	Synthesis of sentences	10
VI	Transformation of sentences	05
VII	Active - Passive Voice	10
VIII	Conjunction	05
IX	Expansion of Ideas / Proverbs (2x5=10)	10
X	Sentence Arrangement	05
XI	Dialogue Writing	05
	<b>Total</b>	<b>100</b>

# GENERAL ENGLISH

## COURSE - VI

Hours: 6

Course Code: 23UGEL36, 23UGEL46

Credits: 3

### LEARNING OUTCOMES

- LO1** To introduce learners to advanced level of poetic English through representative pieces, to make them understand oblique use of language
- LO2** To make them read and understand modern English prose through samples of biography, autobiography, short story and one act play
- LO3** To familiarise them with advanced language structures and the use of idioms and phrasal verbs
- LO4** To make them understand and use different degrees for comparison and use language for reporting speech
- LO5** To acquaint them with the skills of expanding or developing, and condensing ideas
- LO6** To make them speak English fluently and accurately for specific purposes

UNIT	TOPICS	
I	<b>POETRY</b> Edwin Arnold Sylvia Plath John Keats John Donne Maya Angelou	“Siddhartha” “The Mirror” “La Belle Dame Sans Merci” “Death Be Not Proud” “I Know Why the Caged Bird Sings”
II	<b>PROSE, SHORT STORY &amp; DRAMA</b> Anne Frank C.P. Snow Chinua Achebe Hugh Chesterton	“The Diary of a Young Girl” “Hardy and Ramanujan” “Marriage is a Private Affair” “The Pie and the Tart”
III	<b>LANGUAGE COMPETENCY (Grammar and Vocabulary)</b> 1. Degrees of Comparison                      2. Direct- Indirect Speech 3. Cloze Test.                                      4. Idioms and Phrasal verbs 5. Spotting Errors	
IV	<b>LANGUAGE COMPETENCY (Composition)</b> 1. Précis Writing                      2. Essay Writing	
V	<b>SPOKEN ENGLISH</b> 1. Reading and Interpretation                      2. Issue Based Conversation 3. Public Speaking on subject topic                      4. Extempore	



## COURSE OUTCOMES

- CO1 Read and interpret the oblique language of poetry and write appreciative essays on the prescribed literature
- CO2 Read, interpret and write analytical essays about prescribed prose pieces
- CO3 Use advanced grammar structures to report speech and use the three degrees of comparison for intended emphasis
- CO4 Use advanced nuances of language such as idioms and phrasal verbs
- CO5 Write reflective, descriptive, expository and imaginative essays with appropriate content, and condense material to a précis
- CO6 Use English fluently and accurately for public speaking, extempore and other specific purposes

## TEXT BOOKS

- Board of Editors. *Spotlight VI*, India: Ponnasai Publishers & Distributors, 2016.
- Board of Editors. *Active English Grammar and Composition*, India: Trinity Press, 2022

## REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations*, India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage*, India: McGraw Hill Education, 2015
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	1 short essay (200 words) out of 2 from Unit I	10
II	1 essay (300 words) out of 2 from Unit II	15
III	5 Passages with 2 Qns. each (from Units I & II)	10
IV	Degrees of Comparison	05
V	Direct Indirect Speech	10
VI	Making sentences – Idioms	05
VII	Phrasal verbs	05
VIII	Spotting errors ( Multiple Choice )	10
IX	Correcting the errors (Rewriting)	05
X	Cloze Test	05
XI	Precis Writing	10
XII	Essay Writing	10
	<b>Total</b>	<b>100</b>

## GENERAL ENGLISH

### COURSE - VII

Hours: 6

Course Code: 23UGEL47

Credits: 3

#### LEARNING OBJECTIVES

- LO1** To facilitate learners' reading advanced English through representative pieces of Literature
- LO2** To help learners infer and interpret prescribed literature and write coherent, Analytical essays
- LO3** To help learners acquire the advanced use of English for professional purposes
- LO4** To help learners prepare resume and CVs for professional use
- LO5** To encourage learners in using English skillfully and creatively to discuss, brainstorm or debate a topic, through active practice
- LO6** To equip learners with the soft skills necessary for employability

<b>I</b>	<b>DRAMA</b> William Shakespeare <i>Julius Caesar</i>
<b>II</b>	<b>FICTION</b> Charles Dickens <i>Oliver Twist</i>
<b>III</b>	<b>SOFT SKILLS 1 (Theory and Practice)</b> 1. Interview skills*                      2. Group Discussion* 3. Debate                                      4. Interpersonal Skills * Included for Spoken English Viva Voce also
<b>IV</b>	<b>SOFT SKILLS 2 (Theory and Practice)</b> 1. Time Management                      2. Problem Solving Techniques 3. Teamwork                                      4. Leadership
<b>V</b>	<b>APPLICATION &amp; RESUME</b> 1. Chronological Resume.              2. Functional Resume 3. Responding to the given advertisement

#### COURSE OUTCOMES

- CO1** Read and understand advanced forms of English in Literature
- CO2** Interpret and write analytical essays on topics concerning prescribed pieces of literature
- CO3** Speak English fluently and accurately in professional contexts
- CO4** Prepare application with appropriate Resume structure for employment
- CO5** Use English effectively and creatively for interview, group discussion etc.,
- CO6** Behave, react and handle situations connected to employability, using the acquired knowledge of soft skills

## TEXT BOOKS

- Shakespeare, William. *Julius Caesar*, United Kingdom: Oxford University Press, 2008.
- Dickens, Charles. *Oliver Twist*, United Kingdom: Penguin Classics, 2003

## REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations*. India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage*, India: McGraw Hill Education, 2015
- Sinha, R. P. *Current. English Grammar and Usage with Composition*, India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	5 Multiple Choice Questions from Unit I	05
II	5 Multiple Choice Questions from Unit II	05
III	1 Essay (400 words) out of 3 from Unit I	15
IV	1 Essay (400 words) out of 3 from Unit II	15
V	2 Annotations out of 3 from Unit I	10
VI	2 Paragraphs out of 3 from Unit II	10
VII	1 Essay out of 2 from Unit III	15
VIII	1 Essay out of 2 from Unit IV	15
IX	Responding to the given Advertisement	10
	<b>Total</b>	<b>100</b>

**DEPARTMENT OF HUMAN EXCELLENCE**

**St. Xavier's College (Autonomous), Palayamkottai**

**Courses offered**

Semester	Category	Course Code	Course Title
I	FC	23UHER11/ 23UHEE11	Religion: Catholic Doctrine / Ethics
II	SEC3	23UHEI21	Integrated Personality Development
III	SEC4	23UHEL31	Life Coping and Entrepreneurial Skills Management
IV	EVS	23UEVS41	Environmental Studies
V	VE	23UVEH51	Human Rights and Social Analysis

**NME**

Semester	Category	Course Code	Course Title
I	Library	23ULBN11	Foundations of Library Science
I	XRF	23UXRN11	Traditional Knowledge of Indian Medicinal Systems
II	Library	23ULBN21	Information Resources
II	XRF	23UXRN21	Indian Traditional Medicinal Foods
III	XRF	23UXRN31	Food Microbiology
IV	XRF	23UXRN41	Herbal Resources and Their Conservation
IV	MAX Forum	23UMXN41	Society, Economy and Politics in Contemporary India

**Common Question Pattern**

**Internal Test**

Part A	Answer ALL the questions in one or two lines	5 x 2 = 10
Part B	Answer ALL the questions, each in a paragraph	3 x 5 = 15
Part C	Write an essay on the following	1 x 10 = 10

**Semester Exam**

Part A	Answer ALL the questions in one or two lines	10 x 3 = 30
Part B	Answer ALL the questions, each in a paragraph	5 x 8 = 40
Part C	Write an essay on each the following	2 x 15 = 30

**RELIGION: CATHOLIC DOCTRINE  
(23UHER11)**

<b>SEMESTER:I</b>	<b>VE</b>	<b>HOURS:2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS:30</b>
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**Course Outcomes:**

Upon completion of the course the students will be able to

1. Recite the Sacraments(K1)
2. Identify the challenges of the present day church(K1)
3. Associate Old and New testaments of the bible(K2)
4. Explain the Church history(K2)
5. Discuss the Marian worship (K2)
6. Summarize the catholic social teachings(K2)

**Unit I: Introduction to Bible (6 Hours)**

Bible as a Word of God, its inspiration, the Canon - Old and New Testaments and their interconnectedness - Traditional and modern interpretations

**Unit II: Introduction to the Church history (6Hours)**

The beginnings of the Church - Medieval period and its challenges - The importance of the Second Vatican Council and their decrees - Synodality

**Unit III: Introduction to the Sacraments (6Hours)**

The origin of the seven sacraments - Their practices and meanings - History of the sacraments

**Unit IV: Introduction to Mariology (6Hours)**

Mary, Mother of God and Jesus - Mary, our Mother and in the Gospels - Mariology in the history of the Church – Mary as a Prophet of revolution

**Unit V: Church in the Contemporary World (6Hours)**

The challenges of the present day Church – Casteism and Same sex marriage – Ecumenical unity and Inter Religious harmony - Catholic Social Teachings

**REFERENCES:**

1. Paul C. Jesuraj, Growing in Your Faith, July 2022.
2. Second Vatican Council Documents

**ETHICS**  
**(23UHEE11)**

<b>SEMESTER: I</b>	<b>VE</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course Outcomes :**

Upon completion of the course the students will be able to

- Describe the Ethical foundations and human history (K1)
- Identify Ethics and its relationship with Religions (K1)
- List the personal ethical codes to be practices in day to day life (K1)
- Associate ethics in family and society (K2)
- Summarize modern ethical issues and problems (k2)
- Discuss bio and environmental ethics (k2)

**Unit I : Introduction to Ethics** **(6 Hours)**

Meaning, Nature and Scope of Ethics - Challenges and Importance of ethics - Basic Ethical Foundations

**Unit II : Ethics in Religions** **(6 Hours)**

Ethical foundations and meanings in big and small traditions - Ethics and its relationship with Religions

**Unit III : Personal Ethics** **(6 Hours)**

Moral precepts - Dynamics of personal morality - Moral Conscience - Ethical aspects of Thirukural – Evils of Corruption – Gandhi's Seven Deadly Sins.

**Unit IV : Family Ethics and Social Ethics** **(6 Hours)**

Role of Family in ethical formulations- Respecting persons - Peace and Justice - Human Duties

**Unit V : Modern Ethical Issues** **(6 Hours)**

Bio Ethics - Media Ethics - Environmental Ethics –Cyber Ethics

**REFERENCES:**

1. Ethics prepared by School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University (MPYE 002)
2. Course material prepared by the Department of Human Excellence.

**INTEGRATED PERSONALITY DEVELOPMENT**  
**(23UHEI21)**

<b>SEMESTER: II</b>	<b>SEC3</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course Outcomes:**

Upon completion of the course the students will be able to

- Identify personal strengths and weaknesses (K1)
- Identify the means of self-esteem (K1)
- Identify the means of improving personal performance(K1)
- Explain the techniques of self-management(K2)
- Describe coping strategies of learning (K2)
- Discuss the traits of personal competence(K2)
- Summarize different dimensions of Personality (K2)

**UNIT I: Self – Knowledge** **(6 Hours)**

Exploring habits, attitudes, preferences and experience –SWOC analysis – Johari Window – Enhancing one’s self image, self-esteem, self confidence

**UNIT II: Self-Management** **(6 Hours)**

Understanding of life story - Focusing on Internal narratives - Managing change, confusion and uncertainty –Goal setting – Personal Vision and Mission statements

**UNIT III: Personal Competence and Maturity** **(6 Hours)**

Motivation - Developing rapport - Giving and receiving constructive criticism - Assertiveness and negotiation skills – Leadership – Type of Leadership – Qualities of a good leader

**Unit IV: Dimensions of Personality Development** **(6 Hours)**

Recognizing the gradual growth in different dimension of one’s personality such as (a) Physical (b) Intellectual (c) Emotional (d) Moral (e) Social and (f) Spiritual - Learning the Development process; Tools and Skills - Helping to maximize one’s potentials

**Unit IV: Academic Learning Strategies** **(6 Hours)**

Memory - Art of generative listening, learning and writing - Note making - Presentation skills - Time management - Receptive skills - Classroom etiquettes - Cyber knowledge

**REFERENCE BOOKS:**

1. Dr. Xavier Alphonse S.J., We Shall Overcome, ICRDEC Publications, Chennai, 2004.
2. Personality Development, Harold R. Wallace and L. Ann Masters, South-Western, Cengage Learning India PL, New Delhi, 2006.
3. Course material prepared by the Department of Human Excellence

**LIFE COPING AND ENTREPRENEURIAL SKILLS MANAGEMENT**  
**(23UHEL31)**

<b>SEMESTER: III</b>	<b>SEC4</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course Outcomes :**

Upon completion of the course, the students will be able to

1. Identify the various challenges faced in adolescence (K1)
2. Tabulate healthy habits and lifestyle (K1)
3. Identify problem solving strategies (K1)
4. Discuss family and professional relationship(K2)
5. Explain cognitive, emotional and behavioural perspectives (K2)
6. Describe evils of addiction and the remedies available (K2)

**Unit I: Physical AND Mental Wellbeing (6 Hours)**

Adolescent Health and Holistic Health - Understand and appreciate physical Self - Personal hygiene and grooming - Balanced diet - Healthy habits and lifestyle - Sound body and mind - Nurturing health at home, in campus –Definition of Health - Women health – various medicine systems

**Unit II: Interpersonal and Social Wellbeing (6 Hours)**

Family Relationship: Values in family relationship, Nuclear, Joint Family, Dependence, Overdependence, Happy family, Broken Family - Caring Elders - Rapport Building with Peers/ Friends, Strangers, Transgenders - Professional Relationship : Officials, Mentors, Staff & Service Personnel- Other centeredness and others point of view and Empathy

**Unit III: Problem-solving and Decision making skills (6 Hours)**

Decision making processes - Lateral Thinking and problem-solving strategies - Select and apply problem-solving strategies to more complex tasks and problems - Gain familiarity with concepts such as performance indicators and benchmarking – Counseling.

**Unit IV: Coping Strategies (6 Hours)**

Conflict/Crisis Management –Stress Management – Emotional Management - Team, Task and Resource Management – Ignatian Discernment Process

**Unit V: Overcoming Addiction (6 Hours)**

Various stages of addiction- Gadgets addiction - Substance abuse - Media addiction – Internet addiction – Impact, prevention and remedies.

**REFERENCE BOOKS:**

1. Dr. Xavier Alphonse S.J., We Shall Overcome, ICRDEC Publications, Chennai, 2004.
2. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
3. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
4. Course Material prepared by the Department of Human Excellence.



**ENVIRONMENTAL STUDIES**  
**(23UEVS41)**

<b>SEMESTER: IV</b>	<b>EVS</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course objective:**

To cater to students from diverse disciplinary backgrounds and to sensitise them about the commitment of our nation towards achieving sustainable development goals and addressing global environmental challenges.

**Course outcomes:**

The student will be able to:

1. Describe various natural resources and the need for sustainable development (K1).
2. Relate biodiversity and its conservation approaches (K2).
3. Solve the environmental issues of concern and discover prevention strategies (K3).
4. Sensitize and categorize the adverse health impacts of pollution (K3).
5. Assess environmental quality and risks for climate change mitigation (K4 & K5).
6. Recognize the major treaties to safeguard Earth's environment and resources (K2).

**Unit I: Natural Resources and Sustainable Development (6 hours)**

Overview of natural resources: definition, classification. Biotic resources: major types, status and challenges. Water resources: types, over-exploitation, issues, challenges, water scarcity, conflicts. Soil and mineral resources: important minerals, problems, soil as a resource. Energy resources: sources, conventional and non-conventional, implications. Introduction to sustainable development: SDGs, targets and indicators, challenges and strategies.

**Unit II: Conservation of Biodiversity and Ecosystems (6 hours)**

Biodiversity and its distribution: Levels and types, India and world, hotspots, threat categories. Ecosystems and ecosystem services: major types in India, basic characteristics, significance. Threats to biodiversity and ecosystems: land use, commercial exploitation of species and invasive species. Major conservation policies: in situ, ex situ, protected areas, traditional knowledge, community based conservation, gender and conservation.

**Unit III: Environmental Pollution and Health (6 hours)**

Understanding disaster and pollution: definitions, natural and man-made, point source and non-point source, kinds. Air and water pollution: criteria pollutants, sources, and adverse effects, quality standards. Soil and noise pollution: sources and health effects. Thermal and radioactive pollution: sources and impact on health and ecosystems.

**Unit IV: Climate Change: Impacts, Adaptation and Mitigation (6 hours)**

Understanding climate change: structure of atmosphere, natural and anthropogenic variations, importance of 1.5 °C and 2.0 °C limits to global warming, projections of climate change in Indian subcontinent. Impacts, vulnerability and adaptation to climate change. Mitigation of climate change: GHG reduction vs. sink enhancement, concept of carbon intensity, energy intensity and carbon neutrality; policy instruments, carbon capture and storage, climate justice.

## **Unit V: Environmental Treaties and Legislation**

**(6 hours)**

Overview of instruments of international cooperation: bilateral, multilateral, conventions and protocols, COPs. Major International Environmental Agreements: CBD, CITES, UNCCD, UNFCCC. Major Indian Environmental Legislations: acts, rules, sites, areas, zones and judgements. Major International organisations and initiatives: UNEP, IUCN, WCED, UNESCO, IPCC, MAB.

### **Reference books**

1. Singh, J.S., Singh, S.P., Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.
2. Harris, Frances (2012). Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3. Krishnamurthy, K.V. (2003). Textbook of Biodiversity, Science Publishers, Plymouth, UK.
4. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
5. Pittock, Barrie (2009). Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6. Ministry of Environment, Forest and Climate Change (2019). A Handbook on International Environment Conventions & Programmes.
7. KanchiKohli, Manju Menon (2021). Development of Environment Laws in India, Cambridge University Press.

**HUMAN RIGHTS AND SOCIAL ANALYSIS**  
**(23UVEH51)**

<b>SEMESTER: V</b>	<b>VE</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course Outcomes :**

Upon completion of the course, the students will be able to

- Describe Indian social scenario (K1)
- List the different kinds of fundamental rights (K1)
- Discuss major social problems in India (K2)
- Analyze critically society and its network of relationships (K4)
- Analyze local and global social problems (K4)
- Describe redressal mechanisms for human rights violations (K6)

**Unit I: World trends today and Indian Scenario** **(6 Hours)**

Some basic data – Globalization - World Social Forum vs World Economic Forum - The North South divide – Democracy - Types of Governance in the world – Demography and Basic Data of India

**Unit II: Indian Social System** **(6 Hours)**

Social Analysis - Social system and its components - Interdependence of human being and society - A land of cultural linguistic and religious diversity - secularism-communalism-fundamentalism-Indian politics and religion-problems of the minority.

**Unit III: Major Social Problems I** **(6 Hours)**

Indian Economic inequality and Poverty; Manifestation and Measurement; Incidence and Magnitude; Causes, problems of poor and pains of poverty; the remedy - Ignorance in Governance and corruption: The Concept; Causes and Impact of Corruption; Combating Corruption - Illiteracy: Magnitude, Causes and Consequences

**Unit IV: Major Social Problems II** **(6 Hours)**

Caste Discrimination: caste discrimination and process of exclusion, Honour Killing, Untouchability, Caste Politics, Reservation policy – Dalit Empowerment - Child abuse, child labour - Effects of Abuse on Children - Violence against women: Harassment; Nature, Extent and Characteristics – Empowerment of Women - LGBTQIA+ – Currently pressing issues.

**Unit V: Human Rights, Indian Constitutions and Empowerment** **(6 Hours)**

Universal Human Rights: The concept – Evolution – Organizations and Recent Developments – Indian Constitutions: Preamble - Political and Civil fundamental rights and duties. Empowerment Models: Communitarian and Local Models – Social Reformers: Ambedkar, Gandhi, Muthulakshmi Reddy and Periyar - Dreams and hopes for better India.

**REFERENCE BOOKS:**

1. P.N. Sharma, “Social problems and issues in India”, Bharat Book Centre, 2014
2. New India, The Reality Reloaded, Gurjot S. Kaler, Chandigarh, India, 2018
3. Course Material Prepared by the Department of Human Excellence

**FOUNDATIONS OF LIBRARY SCIENCE**  
**(23ULBN11)**

<b>SEMESTER: I</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**COURSE Outcomes:** At the end of the course the students will be able to

- CO1. Comprehend the Evolution, Significance, and Fundamental Operations of Libraries. (K2)
- CO2. Develop Effective Reading Strategies and Critical Thinking Skills. (K3)
- CO3. Differentiate and grasp the distinct roles and functions of various types of libraries. (K4)
- CO4. Explore Modern Library Services and the Impact of Digital Resources. (K4)
- CO5. Recognize the potential of VR, AI, and chatbots in enhancing user support within library environments. (K5)

**UNIT 1 (6 Hours)**

**INTRODUCTION TO LIBRARY**

The history and evolution of libraries - Need - Purpose - Functions - Five Laws of Library Science.

**UNIT 2 (6 Hours)**

**TYPES OF LIBRARY**

Public – Academic – Special - National. (Definition, purpose and functions of each type of library.

**UNIT 3 (6 Hours)**

**LIBRARY SERVICES AND COLLECTION DEVELOPMENT**

Reference services and reader advisory- Collection development and Management - E-books - E-journals Database - Bulletin Boards.

**UNIT 4 (6 Hours)**

**EMERGING TECHNOLOGIES IN LIBRARIES**

Virtual reality and augmented reality in libraries - AI and chatbots for user support - Internet of Things (IoT) applications in libraries.

**UNIT 5 (6 Hours)**

**READING CULTURE FOR LIBRARY PRACTITIONERS**

Value of Reading in Professional Development - Exploring Diverse Reading Materials - Effective Reading Techniques - Critical Thinking and Reflection.

**Text Book**

Kumar P S G, Foundations of Library and Information Science B. R. Publishing Corporation

**Reference**

1. Khanna J K, Library and Society, Kurukshetra University, Kurukshetra
2. Kumar P S G, Foundation of Library and Information Science Paper 1 of UGC Model Curriculum, B.R. Publishing Corporation

**TRADITIONAL KNOWLEDGE OF INDIAN MEDICINAL SYSTEMS  
(23UXRN11)**

<b>SEMESTER: I</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course outcomes:** At the end of the course the students will be able to

**CO1:** Understand the concepts of ethno botany and its branches (K1).

**CO2:** Provide a strong foundation in the principles of ethno medicine and its applications (K2 & K4).

**CO3:** Inculcate knowledge and make the students aware of the commercial value of medicinal plants (K2 & K3).

**CO4:** Give an insight into the edible and medicinal plants in tribal medicine (K3).

**CO5:** Comprehend the advances made in the field of plant biotechnology in conservation of medicinal plant resources (K4).

**CO6:** Understand ethno botany of the Western Ghats, their medicinal and commercial values and conservation (K1- K4).

**Unit I: Ethnobotany (6 hours)**

History of Ethnobotany, concept, scope and objectives. The relevance of ethnobotany in the present context. Major ethnic groups in Tamil Nadu.

**Unit II: Traditional medicines (6 hours)**

Medicinal plants used by Tribals. Ethnobotanical formulations; Ethnobotanical uses of selected medicinal plants with a) *Azadirachthaindica* b) *Ocimumtenuiflorum* c) *Vitexnegundo*. d) *Gloriosasuperba* e) *Tribulusterrestris* f) *Pongamiapinnata* g) *Senna auriculata* h) *Indigoferatinctoria*. Importance and scope of medicinal plants used by *Paliyans*.

**Unit III: Commercial value of traditional medicinal plants (6 hours)**

Raw drugs from ethnomedicinal plants - Economic potentials of selected ethnomedicinal plants. Ethnobotany as a source of important drugs a) Reserpine b) Artemisin c) Gugulipid d) Cathranthin e) Strychnine. Export of medicinal plants and their products.

**Unit IV: Collection, Utilization and Conservation of Traditional Medicinal Plants (6 hours)**

The significance of wild medicinal plants – Collection and utilization of medicinal plants – Therapeutics uses of wild medicinal plants. Role of ethnic groups in the conservation of plant genetic resources. Participatory forest management.

**Unit V: Conventional and modern aspects of medicinal plant propagation (6 hours)**

Plant Propagation; Methods of propagation – conventional - vegetative cutting, layering grafting etc., Modern methods- Tissue culture; Micropropagation, isolation of secondary metabolites from *in vitro* culture

**Textbooks:**

1. P.C. Trivedi, Dr. Pravin Chandra 2011. Text Book of Ethnobotany, Pointer Publishers.
2. Bir Bahadur, K. V. Krishnamurthy, T. Pullaiah. 2021. Ethnobotany of India, 5-Volume Set. Apple Academic Press
3. Jain, A. and Jain, S.K. 2016. Indian Ethno botany - Bibliography of 21st Century Scientific Publishers (India).
4. Cunningham, A. B. (2001). Applied Ethnobotany. Earthscan publishers Ltd. London & Sterling
5. Indian Medicinal Plants -An Illustrated Dictionary-C.P. Khare (Ed.) 2019, ©Springer Science+Business Media, LLC.

**Reference Books**

1. Paul E. Minnis 2000. Ethnobotany: A Reader. University of Oklahoma Press
2. Gary J. Martin, 2014. Ethnobotany A Methods Manual. Springer US.
3. T. Pullaiah, Bir Bahadur, K. V. Krishnamurthy. 2016. Ethnobotany of India Western Ghats and West Coast of Peninsular India. Apple Academic Press
4. Ministry of Environment and Forests. 1994. Ethno biology in India. A Status Report. All India Coordinated Research Project on Ethno biology. Ministry of Environment and Forests. New Delhi
5. Albuquerque, U.P., Ramos, M.A., Júnior, W.S.F., and De Medeiros, P.M. 2017. Ethnobotany.

**Web Resources**

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2816487/>
- [https://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_tk\\_6.pdf](https://www.wipo.int/edocs/pubdocs/en/wipo_pub_tk_6.pdf)
- <https://main.ayush.gov.in/ayush-systems/ayurveda/faq>
- <https://www.who.int/news>
- <https://www.csir.res.in/documents/tkdl>
- <https://www.meity.gov.in/content/national-digital-library>

**INFORMATION RESOURCES**  
**(23ULBN21)**

<b>SEMESTER: II</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course Outcomes:** Upon completion of the course, the students will be able to

- CO1. learn all kinds of Secondary Sources. (K1)
- CO2. Learn electronic reference materials. (K1)
- CO3. Understand the concept and importance of Primary, Secondary and Tertiary sources (K2)
- CO4. Analyze the different Non Documentary Sources (K4)
- CO5. Assess electronic information sources, including e-books and e-journals. (K4)

**UNIT-I : Introduction to Information Sources (6 Hours)**

Definition, Type, Characteristics - Primary, Secondary, Tertiary –Evaluation of print Reference Sources

**UNIT-II: Secondary Sources (6 Hours)**

Definition, Types- Dictionaries, Encyclopedia, Directories, Manuals and Handbooks, Bibliographic sources

**UNIT-III : Non – Documentary Source (6 Hours)**

Formal and Informal – Human Sources, Institutional Information Sources, Technological Gate Keepers and Invisible Colleges.

**UNIT-IV : Electronic Information Sources (6 Hours)**

Meaning- Characteristics- Research database Open Access Resources-Audio resources

**UNIT-V: Online Publishers (6 Hours)**

Detailed study of E-books (Amazon, Sage Publication), E-journals (Springer, Verlog), Database (PROQUEST, EBSCO), Evaluation of E-Resources.

**Reference Books:**

- Singh, G. (2011).Digital libraries and digitization. EssEss Publications.
- 2. Baby M.D. (2000) Peter Clayton, G. E. Gorman. Managing Information Resources in Libraries. Cambridge Publishers.

**INDIAN TRADITIONAL MEDICINAL FOODS  
(23UXRN21)**

<b>SEMESTER: II</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course outcomes:** At the end of the course the students will be able to

- CO1:** Know the foundational principles of health supplements such as functional foods, nutraceuticals, superfoods, etc., and assess their potential within the market context (K1).
- CO2:** Understand the core principles of nutrition, including carbohydrates, proteins, lipids, vitamins, minerals, health-enhancing phytochemicals, and antinutritional factors (K2).
- CO3:** Get knowledge about the origins, traditional uses, nutritional composition, and health advantages of selected plant-based foods (K1).
- CO4:** Know the scientific rationale underlying the health benefits and potential adverse effects of various food substances (K3).
- CO5:** Identify the indigenous wild edible plants found in the Southern Western Ghats and their role in enhancing food security (K1).
- CO6:** Comprehend the fundamental concepts related to food and its significance in promoting health, specifically addressing contemporary health challenges, and demonstrate the ability to apply this knowledge in daily life (K1-K3).

**Unit I: FOOD CULTURE (6 Hours)**

Concept of food and its medicinal value - Food and health in Indian traditional medicine - Effect of globalization on food culture - Fast foods, Junk foods and their impact on the health of children and youth population - Emerging trends in health supplements

**Unit II: MACRONUTRIENTS (6 Hours)**

Carbohydrates and their role in health - Cereals, Millets, and Pseudo - Cereals - Proteins and their importance on health - Pulses and their health benefits - Lipids and their health impacts - Nuts and oil seeds

**Unit III: MICRONUTRIENTS (6 Hours)**

Vitamins, minerals and their health impacts - Hidden hunger - Greens, Vegetables and Fruits

**Unit IV: PHYTOCHEMICALS (6 Hours)**

Health promoting phytochemicals and antinutritional factors - Spices, and beverages - Lower plants as food sources - Mushrooms and their health benefits

**Unit V: WILD EDIBLES & FOOD SECURITY (6 Hours)**

Tribal knowledge of food plants - Seasonal foods and wild edible plants of *Kanikaran* and *Paliyan* tribes of Tamil Nadu - Sustainability, Food Security, and Health

**Text books:**

1. Begum, R.M. 2008. A Textbook of Foods, Nutrition & Dietetics, Sterling Publishers Pvt. Ltd.
2. Mudambi, S.R., Rajagopal, M.V. 2007. Fundamentals of foods, nutrition and diet therapy. New Age International.

**References:**

1. Gopalan, C., Sastri, B.V.R., Balasubramanian, S.C. 2014. Nutritive Value of Indian Foods, National Institute of Nutrition, Hyderabad
2. Dietary Guidelines for Indians – A Manual (English), National Institute of Nutrition, Hyderabad



**FOOD MICROBIOLOGY**  
**(23UXRN31)**

<b>SEMESTER: III</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course outcomes:** Upon successful completion of this course, students should be able to:

**CO1:** Understand the fundamental principles of food microbiology and its importance in the food industry; Apply laboratory techniques for microbial analysis in food samples (K1).

**CO2:** Identify and characterize common food borne pathogens and their sources (K2).

**CO3:** Evaluate methods for food spoilage prevention and preservation (K2).

**CO4:** Describe the role of fermentation in food production and its health implications (K2).

**CO5:** Analyze emerging trends and ethical considerations in food microbiology; Apply regulatory guidelines and best practices for ensuring food safety and quality (K3).

**CO6:** Communicate effectively about food microbiology topics in both written and oral formats; Demonstrate critical thinking and problem-solving skills in food safety and quality assurance (K1-4).

**Unit 1: Introduction to Food Microbiology (6 hours)**

Overview of Food Microbiology; Historical Perspective; Microbial Classification and Taxonomy; Microbial Growth and Factors Affecting Growth; Laboratory Techniques in Food Microbiology

**Unit 2: Food borne Pathogens (6 hours)**

Common Food borne Pathogens (e.g., *Salmonella*, *Escherichia coli*, *Listeria*, *Campylobacter*); Sources of Food borne Pathogens; Detection and Control Strategies; Food borne Illness Outbreaks and Investigations; Food Safety Regulations

**Unit 3: Food Spoilage Microorganisms (6 hours)**

Types of Food Spoilage Microorganisms; Factors Influencing Food Spoilage; Spoilage Detection and Prevention; Food Preservation Methods; Food Packaging and Shelf-Life Extension

**Unit 4: Food Fermentation (6 hours)**

Fermentation in Food Production; Microorganisms Used in Fermentation; Fermented Food Products (e.g., yogurt, cheese, bread); Health Benefits of Fermented Foods; Quality Control in Fermentation

**Unit 5: Food Safety and Quality Assurance (6 hours)**

Food Safety Management Systems (HACCP); Good Manufacturing Practices (GMPs); Food Testing and Analysis; Risk Assessment and Management; Emerging Trends in Food Safety

**Reference Books:**

1. Food Microbiology: An Introduction by Thomas J. Montville and Karl R. Matthews, 2017
2. Foodborne Pathogens: Microbiology and Molecular Biology by Pina M. Fratamico, Arun K. Bhunia, and James L. Smith, 2005
3. Food Microbiology: Fundamentals and Frontiers by Michael P. Doyle, Robert L. Buchanan, and Vijay K. Juneja, 2019
4. Fermented Foods and Beverages of the World by Jyoti Prakash Tamang, 2010
5. Food Safety Management: A Practical Guide for the Food Industry by Yasmine Motarjemi and Huub Lelieveld, 2014

**HERBAL RESOURCES AND THEIR CONSERVATION**  
**(23UXRN41)**

<b>SEMESTER: IV</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course outcomes:** At the end of the course the students will be able to

- CO1:** Understand the concepts in herbalism, medicinal plant trade and National policies (K2)
- CO2:** Recognize the threats and importance of conserving the medicinal plant resources (K2)
- CO3:** Explore the important medicinal plant resources of India, their scientific rationale and applications (K3)
- CO4:** Learn the good agricultural and collection practices of medicinal plants (K1)
- CO5:** Know the cultivation and post-harvest processing of selected medicinal plants cultivated Tamil Nadu (K2)
- CO1:** Understand the role of plant resources in global healthcare and its conservation (K1-K3)

**Unit I: SCENARIO OF HERBALISM (6 Hours)**

History of herbalism - Herbalism across the globe - Trade of herbals in ancient and contemporary India - Global herbal market and India's position

**Unit II: UNSUSTAINABLE USE OF HERBAL RESOURCES (6 Hours)**

Basics of endemism, IUCN categories of threat and CITES - Market demand - Negative impacts of collection from wild resources - Overexploited medicinal plants of India - *In situ* and *ex situ* conservation

**Unit III: HIGHLY USED HERBALS OF INDIA (6 Hours)**

Botany, identification, chemistry and applications of *Aswagandha*, *Seenthil*, *Nilavembu*, *Brahmi*, *Garcinia*, *Glycyrrhiza*, *Amla*, *Vilvam*, *KeelanelliandSatavari*

**Unit IV: CULTIVATION & POST-HARVEST PROCESSING (6 Hours)**

Good agricultural practices - Good collection practices - Storing medicinal plants – Post-harvest methods and value addition

**Unit V: CULTIVATION OF SELECTED MEDICINAL PLANTS (6 Hours)**

Good agricultural and collection practices for *Senkanthal*, *Senna*, *Vinca*, *Tulsi* and *Asogu*- Government schemes for cultivation of medicinal plants - Kitchen and home herbal gardens

**Text book:**

Wallis, T.E. 2018. Textbook of Pharmacognosy (Reprinted edition), CBS Publishers, New Delhi.

**References:**

1. Anonymous, Agro-techniques of selected medicinal plants Vols. I-III. 2014. National Medicinal Plants Board, Government of India.
2. Anonymous, WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. 2003. WHO, Geneva.
3. Ravikumar, K., Ved, D.K. 2000. Illustrated Field Guide to 100 Red Listed Medicinal Plants of Conservation Concern in southern India, FRLHT, Bangalore.
4. Ved, D.K., Goraya, G.S. 2007. Demand and Supply of Medicinal Plants in India. NMPB, New Delhi & FRLHT, Bangalore.

**SOCIETY, ECONOMY AND POLITICS IN CONTEMPORARY INDIA  
(23UMXN41)**

<b>SEMESTER: IV</b>	<b>NME</b>	<b>HOURS: 2</b>	<b>CREDITS: 2</b>	<b>TOTAL HOURS: 30</b>
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**Course Outcome:**

On completion of the course, the students will be able to

- CO1: Relate the concept of state and government (K1)
- CO2: Understand and evaluate different types of societies in India (K2 & K5)
- CO3: Identify and compare role of market in different types of economy (K3)
- CO4: Examine and compare ideas of Ambedkar with other social, economic and political reformers (K4 & K5).
- CO5: Analyse and formulate the casteless society in India.

**UNIT I: STATE AND GOVERNMENT (6 Hours)**

State and Government: Meaning and concepts – Features, characteristics and Nature of State and its dynamics in India

**UNIT II: DYNAMICS OF SOCIETY (6 Hours)**

Society: concept, meaning and basic characteristics of society – different types of societies – stratification of societies in India – Rural-Urban Structures and social Institutions.

**UNIT III: ECONOMY AND MARKET (6 Hours)**

Economy and Market: Meaning and concept, basic characteristics and types of economies – dynamics of economy and market in new economic policy era.

**UNIT IV: SOCIAL, ECONOMIC AND POLITICAL THINKERS IN INDIA (6 Hours)**

Jyotirao Phule, Periyar, Gandhi, Ambedkar and Amartya Sen on interaction of society, economy and politics and its dynamics.

**UNIT V: BUILDING CASTELESS SOCIETY (6 Hours)**

Annihilation of Caste: Meaning and concept - Meaning of sati, childhood marriage, endogamous and exogamy of marriage - Status of Dalit and women in Indian society – Dalit and women emancipation.

**References:**

1. Jodhka, S. S. (2002). Nation and village: Images of rural India in Gandhi, Nehru and Ambedkar. *Economic and political weekly*, 3343-3353.
2. Jodhka, S. S. (2010). Dalits in business: Self-employed scheduled castes in North-West India. *Economic and Political Weekly*, 41-48.
3. Jodhka, S. S. (2016). Ascriptive hierarchies: Caste and its reproduction in contemporary India. *Current Sociology*, 64(2), 228-243.
4. Jodhka, S. S., & Fazal, T. (2021). Religion and Politics in South Asia. *Sociological Bulletin*, 70(4), 447–452. <https://doi.org/10.1177/00380229211062752>
5. Mitra, S. K. (1993). Caste, democracy and the politics of community formation in India. *The Sociological Review*, 41(1\_suppl), 49-71.

6. Mosse, D. (2020). The modernity of caste and the market economy. *Modern Asian Studies*, 54(4), 1225-1271.
7. Nayyar, D. (1998). Economic development and political democracy: interaction of economics and politics in independent India. *Economic and Political Weekly*, 3121-3131.
8. Robinson, R. (2014). Planning and economic development: Ambedkar versus Gandhi. *Invoking Ambedkar: Contributions, Receptions, Legacies*, 59-71.
9. Singh, A. (2014). Gandhi and Ambedkar: Irreconcilable Differences? *International Journal of Hindu Studies*, 18(3), 413-449.
10. Stiglitz, J. E. (2016). *The state, the market, and development* (No. 2016/1). WIDER Working Paper.
11. Vikas, R. M., Varman, R., & Belk, R. W. (2015). Status, caste, and market in a changing Indian village. *Journal of Consumer Research*, 42(3), 472-498.

# ALGEBRA AND TRIGONOMETRY

(Course Code: 23UMTC11)

Semester - I	Core -T1	Hours - 4	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Classify and Solve reciprocal equations (K4)
- CO 2.** Describe the sum of binomial, exponential and logarithmic series (K1)
- CO 3.** Develop the powers and multiples of trigonometric functions in terms of sine and cosine (K6)
- CO 4.** Determine relationship between circular and hyperbolic functions (K3)
- CO 5.** Discuss the different methods of summation of trigonometric series (K2)
- CO 6.** Evaluate trigonometric series using difference method (K5)

**UNIT - I:** (12 hours)

Removal of terms - Sturm's theorem - Newton's method of divisors - Horner's method – related problems.

(Textbook 1: Chapter 6: Sections 19, 27, 29.4 and 30)

**UNIT - II:** (12 hours)

Binomial Series– Exponential Series –Logarithmic series - related problems.

(Textbook 2: Chapter 1: Sections 1.1 – 1.3)

**UNIT - III:** (12 hours)

Expansions of  $\sin n\theta$ ,  $\cos n\theta$  - Expansion of  $\tan n\theta$  in powers of  $\tan \theta$ - Expansions of  $\tan(A+B+C+\dots)$  – Powers of sines and cosines of  $\theta$  in terms of functions of multiple of  $\theta$  – Expansions of  $\sin\theta$ ,  $\cos\theta$  in a series of ascending powers of  $\theta$  - related problems.

(Textbook 3: Chapters 3: Sections 1 - 5)

**UNIT - IV:** (12 hours)

Hyperbolic functions –Inverse hyperbolic functions- Logarithm of a complex number- related problems.

(Textbook 2: Chapters 2 and 3)

**UNIT - V:** (12 hours)

Trigonometric series: Difference method- C+iS method - related problems.

(Textbook 2: Chapter 4: Sections 4.1 and 4.3)

## Text Books:

1. T. K. ManicavachagomPillay, T. Natarajan, K.S. Ganapathy, Algebra, volume I, S.Viswanathan (Printers and Publishers) PVT. LTD, 1999.
2. S. Arumugam and A. Thangapandi Isaac, Summation of Series and Trigonometry, New Gamma Publishing House, 2003.
3. S. Narayanan, T. K. ManicavachagomPillay, Trigonometry, S.Viswanathan (Printers and Publishers) PVT. LTD, 2008.

## Reference Books:

1. C. V. Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003.
2. J. Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012.

# DIFFERENTIAL CALCULUS

(Course Code: 23UMTC12)

Semester - I	Core -T2	Hours - 4	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the basic formulae in differentiation (K1)
- CO 2. Discuss radius of curvature and evolutes using various methods (K2)
- CO 3. Use the Leibnitz theorem to find derivatives (K3)
- CO 4. Determine derivation using Euler's theorem (K3)
- CO 5. Demonstrate the applications of differentiation and Jacobians (K3)
- CO 6. Evaluate maxima and minima functions (K5)

**UNIT - I:** (12 hours)

**Successive Differentiation:** Introduction (Review of basic concepts) – The  $n^{\text{th}}$  derivative – Standard results – Fractional expressions of the form  $\frac{f(x)}{\varphi(x)}$  – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the  $n^{\text{th}}$  derivative of a product.

(Chapter 3: Sections 1.1 – 1.6, 2.1)

**UNIT - II:** (12 hours)

**Partial Differentiation:** Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.

(Chapter 8: Sections 1.1 – 1.5)

**UNIT - III:** (12 hours)

**Partial Differentiation (Continued):** Homogeneous functions – Partial derivatives of a function of two functions – Maxima and Minima (Theorems without proof).

(Chapter 8: Sections 1.6 – 1.7 & Chapter 5: Sections 1.1 -1.5)

**UNIT - IV:** (12 hours)

**Envelope:** Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.

(Chapter 10: Sections 1.1 – 1.5 )

**UNIT - V:** (12 hours)

**Curvature:** Definition of Curvature – Circle, Radius and Centre of Curvature – Cartesian formula for the radius of curvature - Evolutes and Involutives – Radius of Curvature when the curve is given in Polar Co-ordinates.

(Chapter 10: Sections 2.1 – 2.3, 2.5-2.6)

**Text Book :**

S. Narayanan and T. K. Manicavachagompillay, Calculus Volume I, S.Viswanathan (Printers & Publishers) Pvt. Ltd.2004.

**Reference Books :**

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010.
3. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

## ALLIED I: PHYSICS (Theory)

(Course Code: 23UPHE11)

<b>Semester – I</b>	<b>Ec – T1</b>	<b>Hours – 6</b>	<b>Credits – 5</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Students studying allied physics can able to know, various modulus involved in the materials, flow of liquids due to viscous forces (K1)
- CO 2.** Study the various laws involved in heat transformation (K1)
- CO 3.** classify the various thermodynamic laws and the concept of entropy (K4)
- CO 4.** Understand the phenomenon like interference and diffraction (K2)
- CO 5.** Reflecting the optical activity of liquids and its uses (K5)

### **UNIT - I : Elasticity** **(12 Hours)**

Elasticity - Bending of beams - Expression for bending moment - Uniform bending - Theory - Twisting couple on a cylindrical wire - Expression for a couple per unit twist - Work done - Torsional pendulum - Experiment to determine rigidity modulus of the wire using torsional pendulum - Acceleration due to gravity - Compound pendulum - Theory and experiment.

### **UNIT - II : Surface Tension** **(12 Hours)**

Surface tension - Excess of pressure over curved surface - Drop weight method - Coefficient of viscosity and its dimension - Stokes formula for viscous drag - Experiment to determine the coefficient of a highly viscous liquid - Flow of a liquid through a uniform capillary tube - Method of dimensions - Poiseuille's method.

### **UNIT - III : Specific Heat Capacity** **(12 Hours)**

Specific heat capacity - Callendar and Barnes continuous flow method - Variation of specific heat capacity of solids with temperature - Variation of atomic heat of solids with temperature - Theory of specific heat - Einstein theory - Debye's theory.

### **UNIT- 4 : Thermal Conductivity** **(12 Hours)**

Lees disc experiment to determine the thermal conductivity of a bad conductor (cardboard only) - Analogy between heat flow and electric current - Weidemann - Franz law - Newton's law of cooling - Experimental verification - Experiment to determine the specific heat capacity of a liquid - Concept of pressure, volume and temperature of a gas - Mean free path - Expression for mean free path, viscosity and thermal conductivity.

### **UNIT - 5: Conventional Energy** **(12 Hours)**

Conventional energy sources - coal, oil and natural gas - Energy released in a nuclear fission and fusion - Nuclear reactor - Non conventional energy sources-Wind energy - Tidal energy - Wave energy - Photo voltaic effect - Solar cell - Solar ponds.

**Text Books:**

1. A. Ubald Raj & G. Jose Robin - Properties of Matter and Optics, Indira Publications, 1<sup>st</sup> Edition.
2. A. Ubald Raj & G. Jose Robin-Allied physics, vol.2 (Thermal Physics and Sound) Indira Publications, 1<sup>st</sup> Edition.

**Reference Books:**

1. N. Sundararajan, George Thomas, Syed Azeez - College Physics vol 1, United Publishers, 1<sup>st</sup> Edition.
2. A. Ubald Raj & G. Jose Robin – Oscillations, Properties of Matter and Energy Physics and Optics and Spectroscopy - Indira Publications, 1<sup>st</sup> Edition.
3. Brijlal - Heat and Thermodynamics and Statistical Physics, S.Chand & Company – 2010.
4. R.Murugesan - Properties of Matter S. Chand and Company – 2010.



## ALLIED 1: PHYSICS - Practical

(Course Code: 23UPHE12)

<b>Semester – I</b>	<b>Ec -P1</b>	<b>Hours – 2</b>	<b>Credits – 2</b>
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1. Young's modulus - Uniform bending - Telescope
2. Young's modulus - Non-uniform bending - Pin & Microscope
3. Coefficient of Viscosity - Constant pressure head method
4. Surface Tension - Drop weight method
5. Acceleration due to gravity - Compound pendulum
6. Conductivity of bad conductor - Lee's disc method
7. Newton's law of cooling – Verification
8. Specific heat capacity of a liquid - Newton's law of cooling
9. Torsional Pendulum - Determination of rigidity modulus

## NUMERICAL ABILITY – I (NME)

(Course Code: 23UMTN11)

<b>Semester-I</b>	<b>SEC -1</b>	<b>Hours -2</b>	<b>Credits - 2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recall the basic formula to solve the day today problems (K1)
- CO 2.** Discuss HCF and LCM of numbers (K2)
- CO 3.** Apply BODMAS rule to solve the problems (K3)
- CO 4.** Outline the basic concepts related to numerical problems (K4)
- CO 5.** Compare the relation between the percentage, ratio and proportion (K5)
- CO 6.** Build the mental ability to face the competitive examination (K6)

**Eligibility:** All UG students except from the Department of Mathematics

**UNIT - I:** (6 hours)  
Numbers (test of divisibility) - HCF and LCM of numbers.

(Chapters 1 and 2)

**UNIT - II:** (6 hours)  
Decimal fractions - Some basic formulae simplification (BODMAS rule).

(Chapters 3 and 4)

**UNIT - III:** (6 hours)  
Square roots and cube roots –Surds and indices.

(Chapters 5 and 9)

**UNIT - IV:** (6 hours)  
Problems on numbers – Problems on ages -Average.

(Chapters 6, 7 and 8)

**UNIT - V:** (6 hours)  
Percentage – Ratio and Proportion - Chain rule.

(Chapters 11, 13 and 15)

### **Text Book:**

R.S. Aggarwal, Quantitative aptitude for competitive examination, S. Chand, (2022), Edition 4.

### **Reference Books:**

1. Topic-wise solved papers for IBPS/SBI Bank PO/ Clerk prelims and Mains (Quantitative Aptitude – 2010-16), Disha publication.
2. Quantitative Aptitude, P. Gupta, Unique publishers.

# ANALYTICAL GEOMETRY

(Course Code: 23UMTC21)

Semester - II	Core -T3	Hours - 4	Credit - 4
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**Course Outcomes:** By the end of the course students will be able to

- CO 1. Recollect the properties of diameter and conjugate diameter (K1)
- CO 2. Understand the concepts of pole and polar (K2)
- CO 3. Acquire knowledge about polar co-ordinates (K3)
- CO 4. Acquire knowledge of plane and straight lines (K3)
- CO 5. Demonstrate the 3D structures of sphere (K4)
- CO 6. Solving problems related to geometry of two and three dimensions (K3)

**UNIT - I:** (12 hours)

Angle between two lines – Direction Cosines of a line – relation between directions on a straight line – General equation of the first degree, plane- Normal form – angle between two planes – Intercepts of plane through three points.

(Text Book 2: Chapter: 1: Sec: 1.5, 1.6, 1.7, 1.9 and Chapter: 2: Sec: 2.1, 2.2, 2.3 2.4)

**UNIT - II:** (12 hours)

Conic: Polar equation of the conic – tracing the conic – Chord of the conic – Asymptotes of the conic – Equation of the normal, tangent.

(Text Book 1: Chapter: 9, Sections: 9, 10, 11, 12, 14, 15)

**UNIT - III:** (12 hours)

System of Planes-Length of the perpendicular–Orthogonal projection

(Text Book 2: Chapter 2: Sec: 2.5, 2.7, 2.9)

**UNIT - IV:** (12 hours)

Representation of line–angle between a line and a plane – co – planar lines–shortest distance between two skew lines –length of the perpendicular–intersection of three planes

(Text Book 2: Chapter 3: Sec: 3.1, 3.2, 3.4, 3.6, 3.7, 3.8)

**UNIT - V:** (12 hours)

Equation of a sphere-general equation of a sphere- sphere through four given points- plane section of two sphere- intersection of two spheres- sphere with given diameter – sphere through given circle- Angle of intersection of two spheres- condition for the orthogonality.

(Text Book 2: Chapter 6: Sec: 6.1, 6.2, 6.3, 6.4, 6.7)

**Text Books:**

1. Manicavachagom Pillay T.K. and Natarajan T, A Text book of Analytical Geometry Part I- Two Dimensions, S. Viswanathan(Printers and Publishers) Pvt. Ltd. for Ananda Book Depot. 2011.
2. Shanti Narayan and Mittal P.K., Analytical Solid Geometry, S Chand Publishing, 2021.

**Reference Books:**

1. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions
2. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016.
3. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961.
4. S. L. Loney, Co-ordinate Geometry.
5. G.B. Thomas and R. L. Finny, Calculus and Analytical Geometry, Pearson Publication, 9<sup>th</sup> Edition, 2010.

# INTEGRAL CALCULUS

(Course Code: 23UMTC22)

Semester - II	Core -T4	Hours - 4	Credits - 4
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**Course Outcomes:** By the end of the course students will be able to

- CO 1.** Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae (K3)
- CO 2.** Evaluate double and triple integrals and problems using change of order of integration (K5)
- CO 3.** Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution (K3)
- CO 4.** Explain beta and gamma functions and to use them in solving problems of integration (K2)
- CO 5.** Explain Geometric and Physical applications of integral calculus (K2)
- CO 6.** Analyze the geometric applications of Integral calculus (K4)

**UNIT - I:** (12 hours)

Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli's formula. (Chapter 1: Sections 13.1-13.10, 15.1)

**UNIT - II:** (12 hours)

Multiple Integrals - definition of double integrals - evaluation of double integrals - double integrals in polar coordinates - Change of order of integration. (Chapter 5: Sections 1,2.1-2.2, 3.1-3.2)

**UNIT - III:** (12 hours)

Triple integrals -applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces. (Chapter 5: Sections 4,5.1-5.4, 6.1, 7)

**UNIT - IV:** (12 hours)

Change of variables - Jacobian, beta and gamma functions - infinite integral - definitions-recurrence formula of Gamma functions. (Chapter 6: Sections 1.1-1.2, 2.1-2.4, Chapter 7: 1.1-1.5)

**UNIT - V:** (12 hours)

Properties of Beta and Gamma functions- relation between Beta and Gamma functions - Geometric Applications of Integral calculus. (Chapter 7: 2.1-2.3, 3-6, Chapter 2: 1.1-1.4)

**Text Book:**

S. Narayanan, T. K. Manicavachagom Pillay, Calculus Volume II (Ananda Book Depot) PVT. LTD, 2016.

**Reference Books:**

1. S. Arumugam and A. Thangapandi Isaac, Calculus, New Gamma Publishing House, 2003.
2. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd.

## ALLIED PHYSICS – II

(Course Code : 23UPHE21)

Semester – II	Ec– T2	Hours – 4	Credits – 3
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**Course Outcomes:** By the end of the course students will be able to

- CO 1. Makes the learner understand the basic principles of electricity (K2)
- CO 2. Understand the applications of optics in everyday life (K2)
- CO 3. Inculcate the knowledge in electronics circuits (K6)
- CO 4. Learn the basic concepts of relativity (K1)
- CO 5. Understand the principles amplifiers and oscillators (K2)

### UNIT - I : Electric Field (12 Hours)

Coulomb's law – electric field – electric field due to a point charge – electric dipole – electric flux – Gauss law – applications – electric field due to a charged conducting sphere (point inside and outside) – uniformly charged cylinder (line charge) – electric potential – potential difference – relation connecting electric field and electric potential at a point – equipotential surface.

### UNIT - II : AC Circuits (12 Hours)

Self induction of a coil – calculation of self inductance of a long solenoid – alternating current – calculation of average value of alternating current – phase difference between current and voltage in alternating circuits with resistance only, capacitance only and inductance only – LR circuit – LCR series resonance circuit – LCR parallel resonance circuit.

### UNIT – III: Electronics (12 Hours)

Junction diode – biasing – pn diode equation – V-I characteristics – Zener diode – experiments – applications – voltage regulator using Zener diode – Junction transistor – voltage-divider biasing – transistor amplifier – CE configuration – feedback principle – Barkhausen criterion for oscillations – Colpitt's oscillator.

### UNIT – IV: Optics (12 Hours)

Interference – air wedge – Newton's rings – diffraction – experiment to determine the wavelength of monochromatic light using plane transmission grating - polarization – double refraction – Nicol prism – production of plane, circularly, elliptically polarized light.

### UNIT - V : Relativity (12Hours)

Frame of reference – Galilean transformation – Michelson and Morley experiment – special theory of relativity – Lorentz transformation equation – velocity transformation equations - relativistic velocity addition – length contraction – time dilation – variation of mass with velocity – Einstein's mass energy relation.

#### Text Book:

A. Ubald Raj and G. Jose Robin – Allied Physics Vol.I – Indra Publication 1<sup>st</sup> Edition.

**Reference Books:**

1. N. Sundararajan, George Thomas and Syed Azeez – College Physics Vol. II, United Publishers, 1st Edition 2009.
2. N. Sundararajan, George Thomas and Syed Azeez – College Physics Vol. III, United Publishers, 1st Edition 2009.
3. A. Ubald Raj and G. Jose Robin – Relativity, Wave Mechanics and Nuclear Physics, Indra Publication 1<sup>st</sup> Edition 2009.
4. N.Subramanyam , Brijlal and M.N.Avadhanulu – A text book of optics – S.Chand & Company Ltd., 23<sup>rd</sup> Edition 2006.

## ALLIED PHYSICS – II (PRACTICALS)

(Course Code : 23UPHE22)

Semester – II	Ec– P2	Hours – 2	Credits – 3
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1. Grating - Oblique incidence
2. Air wedge - Thickness of wire
3. LCR Series resonance
4. LCR Parallel resonance
5. Newton's rings
6. Zener diode characteristics
7. Diode rectifier
8. Spectrometer grating normal incidence method
9. Spectrometer – Prism - determination of refractive index of glass
10. Focal length of convex lenses in contact and out of contact

## NUMERICAL ABILITY – II (NME)

(Course Code: 23UMTN21)

<b>Semester - II</b>	<b>SEC - 2</b>	<b>Hours - 2</b>	<b>Credits – 2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Describe the specific knowledge of profit and loss (K1)
- CO 2.** Explain the concepts of pipes and cisterns (K2)
- CO 3.** Solve problems related to time and distance (K3)
- CO 4.** Analyze the concepts of Time and Work (K4)
- CO 5.** Compare between the simple interest and compound interest (K5)
- CO 6.** Build mental ability to approach the competitive examination (K6)

**Eligibility:** All UG students except from the Department of Mathematics.

**UNIT - I:** (6 hours)  
Profit and loss – Alligation or Mixture.

(Chapters 12, 21)

**UNIT - II:** (6 hours)  
Time and work - Pipes and cisterns.

(Chapters 16 and 17)

**UNIT - III:** (6 hours)  
Time and distance - Problems on trains - Boats and streams.

(Chapters 18, 20 and 19)

**UNIT - IV:** (6 hours)  
Simple Interest - Compound Interest – Calendar.

(Chapters 22, 23 and 27)

**UNIT - V:** (6 hours)  
Data Interpretation: Tabulation – Bar graphs – Pie chart – Line graphs.

(Chapters 36, 37, 38 and 39)

### **Text Book:**

R.S. Aggarwal, Quantitative Aptitude for competitive examination, S. Chand, (2022), Edition 4.

### **Reference Books:**

1. Topic-wise solved papers for IBPS/SBI Bank PO/ Clerk prelims and Mains (Quantitative Aptitude – 2010-16), Disha publication.
2. P. Gupta, Quantitative Aptitude, Unique publishers.



## SEQUENCES AND SERIES

(Course Code: 23UMTC31)

<b>Semester - III</b>	<b>Core – T5</b>	<b>Hours - 5</b>	<b>Credits - 5</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Describe various types of sequence (K2)
- CO 2.** Discuss the behaviour of alternating series using various tests (K2)
- CO 3.** Demonstrate various inequalities and their applications (K3)
- CO 4.** Use sub-sequences to find the limits of sequences (K3)
- CO 5.** Apply various tests to check the convergence of series (K3)
- CO 6.** Analyze the properties of monotonic sequences. (K4)

**UNIT – I:** (15 hours)

Triangle inequality - arithmetic, geometric and harmonic means - Cauchy - Schwarz inequality, Weierstrass inequalities – miscellaneous problems.

(Chapter: 2)

**UNIT – II:** (15 hours)

Sequences - bounded sequences - monotonic sequences - convergent sequences - divergent and oscillating sequences - the algebra of limits.

(Chapter 3: Sections 3.1 - 3.6)

**UNIT – III:** (15 hours)

Behaviour of monotonic sequences - some theorems on limits - subsequences - limit points - Cauchy sequences - the upper and lower limits of a sequence.

(Chapter 3: Sections 3.7 - 3.12)

**UNIT – IV:** (15 hours)

Infinite series - comparison test - D'Alembert's ratio test (without proof) - root test and condensation test - integral test.

(Chapter 4: Sections 4.1, 4.2, 4.4 and 4.5)

**UNIT – V:** (15 hours)

Alternating series - absolute convergence - test for convergence of series of arbitrary terms - multiplication of series - power series.

(Chapter 5: Sections 5.1- 5.3, 5.5 and 5.6)

### Text Book:

Dr. S. Arumugam and A. ThangaPandiIssac, Sequences and Series, New gamma publishing House, Palayamkottai, 2010.

### Reference Books:

1. Ajit Kumar and S. Kumaresan, Real Analysis, second Indian reprint, CRC Press, 2015
2. S.C Malik, Principles of Real Analysis, first edition, New Age International Private Limited.

**DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND  
FOURIER SERIES**

(Course Code: 23UMTC32 )

Semester -III	Core - T6	Hours - 5	Credits -4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Identify the types of differential equations (K1)
- CO 2.** Discuss the applications of differential equations in various fields (K2)
- CO 3.** Solve the types of differential equations (K3)
- CO 4.** Classify the differential equations (K4)
- CO 5.** Evaluate the first order partial differential equations (K5)
- CO 6.** Use the sine and cosine series in Fourier series (K6)

**UNIT - I:** **(15 Hours)**

Linear equations with constant coefficients - methods of finding complementary functions - methods of finding particular integrals.

(Text Book 1: Chapter 2: Sections 2.1 - 2.4)

**UNIT – II:** **(15 Hours)**

Linear equation with variable coefficients (Type-D method of variation of parameters only) - simultaneous linear differential equations.

(Text Book 1: Chapter 2: Sections 2.5, 2.6)

**UNIT - III:** **(15 Hours)**

Formation of partial differential equations - first order partial differential equations - methods of solving first order p.d.e – some standard forms - Charpit’s method.

(Text Book 1: Chapter 4: Sections 4.1 - 4.5)

**UNIT - IV:** **(15 Hours)**

Definition - sufficient conditions for the existence of the Laplace transform – Laplace transform of periodic functions - some general theorems - the inverse transforms.

(Text Book 2: Chapter 5: Sections 5.1- 5.7)

**UNIT - V:** **(15 Hours)**

Definition - even and odd functions - half- range Fourier series - development in cosine series - development in sine series.

(Text Book 2: Chapter 6: Sections 6.1 – 6.5)

**Text Books:**

1. Dr. S. Arumugam and Thangapandi Issac, Differential Equation and Applications, Publishing House, 2008.
2. S. Narayanan and T.K. Manicka Vachagam Pillay, Calculus (Volume III), S. Viswanthan Publishers Pvt., Ltd., Chennai, 2006.

**Reference Books:**

1. Richard Bronson and Gabriel B. Costa, Differential equations (fourth edition), McGraw Hill education, 2014.
2. N.P. Balli, Differential Equation (Golden Math series), Firewall media, 2015.
3. Joel L. Schiff, The Laplace Transform (Theory and applications), Springer, 1999.

# MATHEMATICAL STATISTICS - I

(Course Code: 23 UMTE 31)

Semester - III	EC - T3	Hours - 4	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to:

- CO 1. Recall the fundamental properties of probability theory (K1).
- CO 2. Discuss discrete and continuous random variables (K2).
- CO 3. Illustrate different probability distributions (K3).
- CO 4. Apply discrete probability distributions to solve problems (K3).
- CO 5. Apply continuous probability distributions to solve problems (K3).
- CO 6. Analyze various characteristics of expectation and variance (K4).

**UNIT - I:** (12 hours)

Basic Terminology – Some Theorems on Probability – Conditional probability- Multiplication Theorem of Probability – Independent Events - Baye's theorem and its applications.

(Chapter 3: Section 3.3-3.5, 3.9, 3.9.1, 3.10-3.12,  
Chapter 4: Section 4.2 (Except 4.2.1))

**UNIT - II:** (12 hours)

Random variable - Distribution function - Discrete random variable - Continuous random variable - Two-dimensional random variable.

(Chapter 5: Section 5.1 - 5.5 (Except 5.5.6-5.5.7))

**UNIT - III:** (12 hours)

Mathematical expectation – Expected value of function of a random variable – Properties of expectation – Properties of variance - Covariance - Moment generating function.

(Chapter 6: Section 6.2 - 6.6. Chapter 7: Section 7.1)

**UNIT - IV:** (12 hours)

Binomial distribution - Poisson distribution – Geometric distribution

(Chapter 8: Section 8.4(Except 8.4.3, 8.4.10-8.4.12), 8.5 and 8.7)

**UNIT - V:** (12 hours)

Normal distribution - Gamma distribution – Exponential distribution

(Chapter 9: Section 9.2 (Except 9.2.11-9.2.15), 9.8)

**Text Book:**

S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand and Sons, 1982.

**Reference Books:**

1. P.R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2004.
2. J.N. Kapur and H.C. Saxena. Mathematical Statistics 20th Edition, S. Chand & Co Ltd. New Delhi, 2010.

# MATHEMATICS FOR COMPETITIVE EXAMINATIONS – I

(Course Code: 23UMTN31)

<b>Semester - III</b>	<b>SEC - 5</b>	<b>Hours - 2</b>	<b>Credits - 2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Explain the concept of coding and decoding (K2)
- CO 2.** Use the analytical thinking in various situations (K3)
- CO 3.** Analyze the given series of data (K4)
- CO 4.** Select the figures to complete given pattern (K5)
- CO 5.** Develop the mental ability and power of reasoning (K6)
- CO 6.** Develop the competency to face competitive examinations (K6)

**Eligibility:** All UG students except from the Department of Mathematics

**UNIT- I:** (6 hours)

Series Completion – Analogy - Classification  
(Text book – 1: Part I & Section I: Chapters 1, 2 and 3)

**UNIT- II:** (6 hours)

Coding-Decoding - Mathematical Operations.  
(Text book – 1: Part I & Section I: Chapters 4 and 13)

**UNIT- III:** (6 hours)

Logical sequence of words- Arithmetical Reasoning – Data Sufficiency  
(Text book – 1: Part I & Section I: Chapters 14, 15 and 17)

**UNIT- IV:** (6 hours)

Series completion - Mirror Images - Water Images- Spotting out the embedded figures  
(Text book – 1: Part II: Chapters 1, 5, 6 and 7)

**UNIT- V:** (6 hours)

Calendar – Clock – Odd Man Out and Series  
(Text book – 2: Section I: Chapter 27,28, 35)

## **Text Books:**

1. Dr. R.S. Aggarwal, A modern approach to verbal and non-verbal reasoning, S. Chand and Company Ltd, Ram Nagar, New Delhi.
2. Dr. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Ltd, Ram Nagar, New Delhi.

## **Reference Book:**

J. K. Chopra, Reasoning and Aptitude test, Unique Publishers, 2012.

## REAL ANALYSIS

(Course Code: 23UMTC41)

Semester - IV	Core – T7	Hours -6	Credits - 5
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the knowledge on real number system (K1)
- CO 2. Discuss the concept of continuity and differentiability (K2)
- CO 3. Apply the higher order derivatives (K3)
- CO 4. Analyze the behavior of series (K4)
- CO 5. Analyze the relation between differentiation and integration (K4)
- CO 6. Evaluate definite integrals (K5).

**UNIT – I:** (18 hours)

Algebra of the real number system – upper and lower bounds – l.u.b. property and its applications – absolute value and triangle inequality

(Chapter: 1)

**UNIT – II:** (18 hours)

Continuous functions -  $\epsilon$ - $\delta$  definition of continuity – Intermediate value theorem – Extreme value theorem – monotone Functions.

(Chapter: 3: Sections 3.1-3.5)

**UNIT – III:** (18 hours)

Limits - uniform continuity – differentiability of functions - Mean value theorem – L’ Hospital’s rule (statement only).

(Chapter: 3: Sections 3.6-3.7, Chapter 4: Sections 4.1- 4.2)

**UNIT – IV:** (18 hours)

Higher order derivatives – Taylor’s theorem – Darbouxintegrability – properties of the integral.

(Chapter 4: Sections 4.4 - 4.5, Chapter 6: Sections 6.1- 6.2)

**UNIT – V:** (18 hours)

Fundamental theorem of Calculus - Mean value theorem for integrals – Riemann’s definition – Sum of an infinite series as an integral.

(Chapter 6: Sections 6.3, 6.4, 6.6 and 6.7)

### Text Book:

Ajith Kumar and S. Kumaresan, A basic course in Real Analysis, Second Indian Reprint, CRC Press, 2016.

### Reference Books:

1. S.C Malik, Principles of Real Analysis, first edition, New Age International Private Limited, 2017
2. Robert G. Bartle, Donald R. Sherbert, Principles of Real Analysis, first edition, New Age International Private Limited, 2014

## MATHEMATICAL STATISTICS - II

(Course Code: 21UMTE41)

Semester - IV	EC – T4	Hours - 6	Credits - 5
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Interpret the concept of correlation coefficients (K2)
- CO 2. Discuss the various types of sampling (K2)
- CO 3. Explain the procedure for testing of hypothesis (K2)
- CO 4. Describe the applications of t and F distributions (K2)
- CO 5. Demonstrate the use of the chi-square distribution (K3)
- CO 6. Analyze the types of estimators (K4)

**UNIT - I:** (18 hours)

Introduction – Meaning of Correlation – Scatter diagram – Karl Pearson’s Coefficient of Correlation – Rank Correlation.

(Chapter 10: Section: 10.1 - 10.4, 10.7)

**UNIT - II:** (18 hours)

Introduction - Types of Sampling - Parameter and Statistic - Tests of significance - Procedure for testing of hypothesis - Test of significance for large samples - Sampling of attributes – Sampling of variables. (Chapter 14)

**UNIT - III:** (18 hours)

Introduction – Derivation of the chi-square distribution – MGF of chi-square distribution - Applications of chi-square distribution.

(Chapter 15: Section 15.1- 15.3, 15.6 (Except 15.6.4-15.6.7))

**UNIT - IV:** (18 hours)

Introduction – Student’s t- distribution - Applications of t-distribution – Distribution of sample correlation coefficient when population correlation coefficient is zero- F-distribution - Applications of F-distribution. (Chapter 16: Section 16.1-16.6)

**UNIT - V:** (18 hours)

Introduction - Characteristics of estimators – Unbiasedness - Consistency - Efficient and Most Efficient Estimators – Methods of Estimation - MLE (statement of properties and direct simple problems, no theorems).

(Chapter 17: Section 17.1-17.2 (Except MVU Estimators and 17.2.4), 17.6 (Except 17.6.2 - 17.6.4))

**Text Book:**

S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11<sup>th</sup> edition, Sultan Chand and Sons, 1982.

**Reference Books:**

1. P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2004.
2. J.N. Kapur and H.C. Saxena. Mathematical Statistics 20th Edition, S. Chand & Co Ltd. New Delhi, 2010.

## MATHEMATICS FOR COMPETITIVE EXAMINATIONS - II

(Course Code: 23UMTN41)

Semester - IV	SEC - 6	Hours - 2	Credits - 2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Explain the concept of blood relation (K2)
- CO 2. Use the analytical thinking in various situations (K3)
- CO 3. Evaluate the data interpretation problems. (K5)
- CO 4. Select the figures to complete given pattern (K5)
- CO 5. Develop the mental ability and power of reasoning (K6)
- CO 6. Develop the competency to face competitive examinations (K6)

**Eligibility:** All UG students except from the Department of Mathematics

**UNIT- I:** (6 hours)

Blood Relations - Puzzle Test - Inserting the missing character.

(Text book – 1: Part I & Section I: Chapters 5, 6 and 16)

**UNIT- II:** (6 hours)

Direction Sense Test-Logical Venn Diagram – Verification of Truth of the Statement

(Text book – 1: Part I & Section I: Chapters 8, 9 and 21)

**UNIT- III:** (6 hours)

Alphabet Test- Alpha Numeric Sequence Puzzle

(Text book – 1: Part I & Section I: Chapters 10 and 11)

**UNIT- IV:** (6 hours)

Analytical Reasoning- Completion of Incomplete Pattern- Figure matrix

(Text book – 1: Part II: Chapters 4, 8 and 9)

**UNIT- V:** (6 hours)

Data Interpretation: Tabulation – Bar Graphs

(Text book – 2: Section II: Chapter 36 and 37)

**Text Books:**

1. R.S. Aggarwal, A modern approach to verbal and non-verbal reasoning, S. Chand and Company Ltd, Ram Nagar, New Delhi.
2. Dr. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Ltd, Ram Nagar, New Delhi.

**Reference Book:**

J. K. Chopra, Reasoning and Aptitude Test, Unique Publishers, 2012.

**VECTOR CALCULUS AND APPLICATIONS**  
(Course Code: 23UMTS42)

<b>Semester - IV</b>	<b>SEC - 7</b>	<b>Hours - 2</b>	<b>Credits - 2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recollect concept of dot product and cross product in vectors (K1)
- CO 2.** Describe the differentiation of vectors (K2)
- CO 3.** Apply the concepts of gradient, divergence and curl to solve the vector differentiation problems (K3)
- CO 4.** Associate line and surface integrals using Green's and Stokes' theorems (K3)
- CO 5.** Test Gauss divergence theorem (K5).
- CO 6.** Test Green's theorem and Stokes theorem (K5).

**UNIT - I:** **(6 hours)**

Vector algebra - Differentiation of vectors – Gradient

**(Chapter 5: Sections 5.1 - 5.3)**

**UNIT - II:** **(6 hours)**

Divergence and Curl.

**(Chapter 5: Section 5.4)**

**UNIT - III:** **(6 hours)**

Line integrals

**(Chapter 7: Sections 7.1)**

**UNIT - IV:** **(6 hours)**

Surface integrals

**(Chapter 7: Sections 7.2)**

**UNIT - V:** **(6 hours)**

Theorems of Green, Gauss and Stokes.

**(Chapter 7: Sections 7.3)**

**Text Book:**

S. Arumugam and Thangapandi Isaac, Analytical Geometry 3D and Vector Calculus, New Gamma Publishing House, 2011.

**Reference Book:**

George B. Thomas, Maurice D. Weir, Joel Hass and Frank R. Giordano, Thomas' Calculus (Eleventh Edition), Pearson Publications, 2009



# ABSTRACT ALGEBRA

(Course Code: 23UMTC51)

Semester – V	Core – T8	Hours - 6	Credits –5
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Describe the concept of group and its related topics (K1)
- CO 2.** Explain homomorphism and isomorphism (K2)
- CO 3.** Demonstrate subgroup, normal subgroup and quotient group (K3)
- CO 4.** Analyze Integral domain and Euclidean domain. (K4)
- CO 5.** Categorize integral domain using unique factorization theorem (K4)
- CO 6.** Interpret polynomials over fields and its properties (K2)

**UNIT - I:** (18 hours)

Groups and subgroups - Simple properties - Cyclic groups - Cosets and Lagrange's theorem.

(Chapter 2: Sections 2.1 - 2.2, Sections 2.4 – 2.6)

**UNIT - II:** (18 hours)

Normal subgroups - Quotient groups – Homomorphism – Isomorphism.

(Chapter 2: Sections 2.7 - 2.9)

**UNIT – III:** (18 hours)

Automorphisms - Permutation groups - Definition and properties of rings - Special classes of rings.

(Chapter 2: Sections 2.10 - 2.11, Chapter 3: Sections 3.1 - 3.3)

**UNIT – IV:** (18 hours)

Subrings and subfields - Ideals and Quotient rings – Homomorphisms - Maximal and Prime ideals.

(Chapter 3: Sections 3.4 - 3.7)

**UNIT – V:** (18 hours)

The Characteristic of an Integral domain - Definition and properties of Euclidean domain - The Unique Factorization theorem – Gaussian integers.

(Chapter 3: Section 3.8, Chapter 4: Sections 4.1 - 4.3)

## Text Book:

M.L. Santiago, Modern Algebra, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2001.

## Reference Books:

1. S. Arumugam, A.T. Issac, Modern Algebra, Scitech publishers, 2015.
2. Vijay K. Khanna, S. K. Bhambri, A Course in Abstract Algebra, Fifth edition, Vikas publishing house private limited, 2016.
3. Sharma. J.N. and A.R. Vashistha – “Linear Algebra”, Krishna Prakash Nandir 1981.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

**MODERN ANALYSIS**  
(Course Code: 23UMTC52)

<b>Semester - V</b>	<b>Core - T9</b>	<b>Hours - 6</b>	<b>Credits - 4</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Differentiate countable and uncountable sets (K2)
- CO 2.** Discuss the properties related to connected set and compact spaces (K2)
- CO 3.** Associate the concepts learnt in real line and metric space (K2)
- CO 4.** Illustrate the properties of complete set (K4)
- CO 5.** Derive various concepts in topology (K6)
- CO 6.** Develop the related concepts in advanced analysis (K6)

**UNIT – I:** **(18 hours)**  
Countable Sets - uncountable sets - metric space - definition and examples - bounded sets in a metric space - open ball- open sets.  
(Chapter 1: Sections 1.2 and 1.3, Chapter 2: Sections 2.1- 2.4)

**UNIT – II:** **(18 hours)**  
Subspaces - interior of a set - closed sets – closure - limit point - dense sets.  
(Chapter 2: Sections 2.5-2.10)

**UNIT – III:** **(18 hours)**  
Complete metric space – completeness - Baire’s category theorem - continuity – homeomorphism - uniform continuity.  
(Chapter 3: Section 3.1 and 3.2, Chapter 4: Sections 4.1 - 4.3)

**UNIT – IV:** **(18 hours)**  
Connectedness - definition and examples - connected subsets of R - connectedness and continuity  
(Chapter 5: Sections 5.1 - 5.3)

**UNIT – V:** **(18 hours)**  
Compactness - compact space - compact subsets of R - equivalent characterization for compactness - compactness and continuity  
(Chapter 6: Sections 6.1 - 6.4)

**Text Book:**

Dr. S. Arumugam and Mr. A. ThangapandiIssac, Modern Analysis, New Gamma Publishing House, Palayamkottai, 2007.

**Reference Books:**

1. Narayanan Shanti, Mittal P. K., A Course of Mathematical Analysis, S. Chand publishing company, 2005.
2. S. Kumaresan, Topology of metric space, Second edition, Narosa publication, 2011.

**GRAPH THEORY**  
(Course Code: 21UMTC53)

<b>Semester - V</b>	<b>Core – T10</b>	<b>Hours - 5</b>	<b>Credits - 4</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recall the various types of graph (K1)
- CO 2.** Discuss bridges, spanning trees, cut vertices and connectivity (K2)
- CO 3.** Illustrate the Euler and the Hamiltonian graphs (K3)
- CO 4.** Illustrate vertex colouring and edge colouring (K4)
- CO 5.** Summarize the various characteristics of graphs (K5)
- CO 6.** Derive the solutions for logistics problems using vertex and edge colourings (K6)

**UNIT - I:** **(15 hours)**  
The definition of a graph - more definitions - vertex degree - sub graphs - paths and cycles  
(Chapter 1: Sections 1.1, 1.3 - 1.6)

**UNIT - II:** **(15 hours)**  
Definitions and simple properties - bridges - spanning trees – cut vertices and connectivity.  
(Chapter 2: Sections 2.1 - 2.3 and 2.6)

**UNIT - III:** **(15 hours)**  
Euler Tours - Hamiltonian graphs - matchings - augmenting paths  
(Chapter 3: Sections 3.1, 3.3, (Omit Fleury’s algorithm and Theorem 3.5), Chapter 4: Sections 4.1)

**UNIT - IV:** **(15 hours)**  
Plane and planar graphs - Euler’s Formula - the dual of a plane graph.  
(Chapter 5: Sections 5.1, 5.2 and 5.6)

**UNIT - V:** **(15 hours)**  
Vertex colouring - critical graphs - edge colouring  
(Chapter 6: Sections 6.1, 6.3 and 6.5 (Omit Theorems 6.5 and 6.14))

**Text Book:**

John Clark, Derek Allan Holton, A First Look at Graph Theory, world scientific, 1991.

**Reference Books:**

1. S. Arumugam and S. Ramachandran. Invitation to Graph Theory, 2006.
2. C. Vasudev, Graph Theory with Applications, 2006.

## PROGRAMMING IN PYTHON THEORY

(Course Code: 23UMTC54)

Semester - V	Core T-11	Hours - 4	Credits – 3
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the various types of programming (K1)
- CO 2. Discuss about decision making statements (K2)
- CO 3. Illustrate the the looping statements (K3)
- CO 4. Illustrate functions and their usages (K4)
- CO 5. Summarize network programming (K5)
- CO 6. Derive the regular expressions (K6)

**UNIT - I:** (12 hours)

Basic syntax – variable types – basic operators.

**UNIT - II:** (12 hours)

Decision making – loops – numbers.

**UNIT - III:** (12 hours)

Strings – lists – tuples – dictionary.

**UNIT - IV:** (12 hours)

Functions – modules – regular expressions.

**UNIT - V:** (12 hours)

CGI programming – database access – network programming.

### Text Book:

Python Tutorial - link: [https://www.tutorialspoint.com/ebook/python\\_tutorial/index.asp](https://www.tutorialspoint.com/ebook/python_tutorial/index.asp)

### Reference Books:

1. Joseph Joyner, Python programming for beginners (Python programming language tutorial ), Kindle edition.
2. Allen Downey, Jeffrey Elkner, Chris Meyers, Learning with Python, dream tech press, 2015.

## PROGRAMMING IN PYTHON PRACTICAL

(Course Code: 23UMTC55 )

<b>Semester - V</b>	<b>Core-P3</b>	<b>Hours - 2</b>	<b>Credits -2</b>
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1. Simple programs to use input/output operations
2. Program using operators
3. Decision Making Programs
4. Programs using Loops
5. Programs String Manipulation
6. Programs using Lists
7. Programs using Tuples.
8. Programs using Functions
9. Programs using Regular Expressions
10. Programs using arrays

# LINEAR PROGRAMMING AND GAME THEORY

(Course Code: 23UMTE51)

Semester - V	EC – T5	Hours - 5	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the simplex algorithm (K1)
- CO 2. Describe graphical solution method to solve LPP (K2)
- CO 3. Illustrate Big-M method and inverting a matrix (K3)
- CO 4. Apply Hungarian method to solve assignment problem (K3)
- CO 5. Outline MODI method to solve transportation problem (K4)
- CO 6. Design methods to solve  $m \times n$  game (K6)

**UNIT - I:** (15 hours)

Introduction - mathematical Formulation of the problem - Introduction - graphical solution method - some exceptional cases - general linear programming problem - canonical and standard forms of L.P.P.

(Chapter: 2, 3 (Sections 3.1 – 3.5))

**UNIT - II:** (15 hours)

Introduction - fundamental properties of solutions (statement of the theorems and problems only) - the computational procedure - the simplex algorithm - use of artificial variables (BIG - M method only) - solutions of simultaneous linear equations – inverting a matrix using simplex method – applications of simplex method.

(Chapter 4)

**UNIT - III:** (15 hours)

Introduction - general transportation - the transportation table - loops in transportation tables - solution of a transportation problem - finding an initial basic feasible solution - test for optimality - degeneracy in transportation problem - transportation algorithm (MODI method).

(Chapter 10: Sections 10.1 – 10.12)

**UNIT - IV:** (15 hours)

Introduction - mathematical formulation of the problem - the Assignment method special cases - the travelling salesman problem.

(Chapter 11: Sections 11.1 – 11.4 and 11.6)

**UNIT - V:** (15 hours)

Introduction - Two person zero - sum games - some basic terms - the maximin - minimax principle - games without saddle point - mixed strategies - graphical solution – dominance.

(Chapter 17: Sections 17.1 – 17.7)

**Text Book:**

Operations Research, KandiSwarup, P.K. Gupta and Man Mohan, Sultan Chand and Sons, New Delhi, 2006.

**Reference Book:**

G. V. Shenoy, Linear Programming methods and Applications, second edition, New age international (p) limited, 2007.

# OPERATIONS RESEARCH

(Course Code: 23UMTE51)

Semester - V	EC-T5	Hours - 5	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall various methods to solve a game (K1)
- CO 2. Describe dynamic programming to solve LPP (K2)
- CO 3. Illustrate replacement, recruitment and promotion problem (K3)
- CO 4. Outline techniques in calculus to solve inventory problem (K4)
- CO 5. Evaluate the methods of solving real time problems using network models by PERT/CPM (K5)
- CO 6. Design methods to solve managerial problems. (K6)

**UNIT - I: (15 hours)**

Introduction –the recursive equation approach – characteristics of dynamic programming – dynamic programming algorithm – solution of discrete DPP – some applications - Solution of LPP by dynamic programming.

(Chapter 13)

**UNIT - II: (15 hours)**

Introduction – Two-Person Zero-Sum Games - some basic terms - the maximin and minimax principles - Games without saddle points - mixed strategies - graphic solution of  $2 \times n$  and  $m \times 2$  games - Dominance property.

(Chapter 17: Sections 17.1 - 17. 7)

**UNIT - III: (15 hours)**

Introduction - replacement of equipment - asset that deteriorates gradually - replacement of equipment that fails suddenly - recruitment and promotion problem.

(Chapter 18: Sections 18.1 - 18. 4)

**UNIT - IV: (15 hours)**

Introduction - the inventory decisions - costs associated with inventories - factors affecting inventory control - economic order quantity - deterministic inventory problems with no shortages - with shortages - EOQ problems with price breaks – multi item deterministic problems (solutions of inventory models are not for examination).

(Chapter 19: Sections 19.1 - 19.9)

**UNIT - V: (15 hours)**

Introduction - network and basic components logical sequencing - rules of network constructions - critical path analysis - probability considerations in PERT - distinction between PERT and CPM.

(Chapter 21)

**Text Book:**

KantiSwarup, P.K. Gupta and Manmohan, Operations Research, Ninth revised edition, Sultan Chand and Sons, New Delhi, 2001.

**Reference Books:**

Prem Kumar Gupta and D.S. Hira, Operations Research – An Introduction, S. Chand and Company Ltd., New Delhi, 2015.

## NUMBER THEORY

(Course Code: 23UMTE51 )

Semester - V	EC -T5	Hours - 5	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Describe the well-ordering principle and the Archimedean property (K1)
- CO 2. Discuss division algorithm, Euclidean algorithm and their application (K2)
- CO 3. Demonstrate fundamental theorem of arithmetic (K3)
- CO 4. Analyze the basic properties of congruence (K4)
- CO 5. Argue the divisibility tests and the linear congruence (K5)
- CO 6. Test the primality of numbers by using Wilson's theorem (K5)

**UNIT- I:** (15 hours)

Well-ordering principle – Archimedean property – principle of finite induction – the binomial theorem.

(Chapter 1)

**UNIT- II:** (15 hours)

The division algorithm – greatest common divisor – the Euclidean algorithm

(Chapter 2)

**UNIT- III:** (15 hours)

The fundamental theorem of arithmetic – the Sieve of Eratosthenes – the Goldbach conjecture

(Chapter 3)

**UNIT- IV:** (15 hours)

Basic properties of congruence – special divisibility tests – linear congruences

(Chapter 4)

**UNIT- V:** (15 hours)

Fermat's factorization theorem – the Little theorem – Wilson's theorem.

(Chapter 5)

### Text book:

David M. Burton, Elementary Number Theory, 4<sup>th</sup> edition, The McGraw-Hill Companies Inc., 1998.

### Reference book:

S.B. Malik, Basic Number Theory, Vikas Publishing House PVT LTD, Reprint 2006.



# LINEAR ALGEBRA AND LATTICES

(Course Code: 23UMTC61)

Semester - VI	Core – T13	Hours - 6	Credits - 4
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**Course Outcomes:** By the end of the course the students will be able to

**CO 1.** Define vector space, Linear independency and Homomorphism (K1)

**CO 2.** Describe different kinds of lattices (K1)

**CO 3.** Associate matrices and vector spaces (K2)

**CO 4.** Determine eigen values and eigen vectors (K3)

**CO 5.** Calculate the dimension of the given vector space (K3)

**CO 6.** Outline the vector space and its related concepts (K4)

**UNIT – I:** (18 hours)

Definition and simple properties of a vector space - Subspace and quotient spaces - Sums and direct sums - Linear independence.

(Text Book 1 - Chapter 6: Sections 6.1 - 6.4)

**UNIT – II:** (18 hours)

Basis and dimension – Homomorphism - Dual spaces.

(Text Book 1 - Chapter 6: Sections 6.5 - 6.7)

**UNIT – III:** (18 hours)

Inner product spaces - Eigen values and eigen vectors - Matrix algebra.

(Text Book 1 - Chapter 6: Section 6.8, Chapter 7: Sections 7.2 - 7.3)

**UNIT – IV:** (18 hours)

The rank of a matrix - Linear equation - Hermitian and unitary transformations.

(Text Book 1 - Chapter 7: Sections 7.6, 7.7 and 7.9)

**UNIT – V:** (18 hours)

Partially ordered set – Lattices - Distributive lattices - Modular Lattices - Boolean algebra

(Text Book 2 - Chapter 9: Sections 9.1 - 9.5)

## Text Books:

1. M. L. Santiago, Modern Algebra, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2001
2. Modern Algebra, Dr. S. Arumugam, A. Thangapandi Issac, SCITECH publications (India) (P) limited, 2003

## Reference Books:

1. Seymour Lipschutz, 3000 solved problems in linear algebra, Schaum's solved problem series, 1988.
2. Vijay K. Khanna, S. K. Bhambri, A Course in Abstract Algebra, Fifth edition, Vikas publishing house private limited, 2016.

**COMPLEX ANALYSIS**  
(Course Code: 23UMTC62)

<b>Semester - VI</b>	<b>Core - 14</b>	<b>Hours - 6</b>	<b>Credits - 4</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Identify the isolated singularities of a function (K1)
- CO 2.** Explain the concept of mappings and transformations (K2)
- CO 3.** Show the significance of differentiability for complex functions (K3)
- CO 4.** Summarize the concepts of continuity, derivatives and analytic functions in contour integrals (K5)
- CO 5.** Analyze the functions with reference to Taylor and Laurent series (K4)
- CO 6.** Evaluate the complex integrals using the residue theorem (K5).

**UNIT - I: (18 hours)**

Complex numbers - sums and products - vectors and moduli - complex conjugates - exponential forms - products and quotients in exponential form - roots of complex number – examples – regions in complex plane - analytic functions - functions of a complex variable - mappings - mappings by the exponential function – limits - theorems on limits - limits involving the point at infinity – continuity – derivatives - differentiation formulas - Cauchy-Riemann equations - sufficient condition for differentiability.

**(Chapter 1: Sections 1, 4 - 10, Chapter 2: Sections 11 - 21)**

**UNIT - II: (18 hours)**

Polar coordinates - analytic functions – examples - harmonic functions - mapping by elementary functions - linear transformation - the transformation  $w = 1/z$  - mapping by  $1/z$  - linear fractional transformations - an implicit form - mappings of the upper half plane

**(Chapter 2: Sections 22 - 25, Chapter 8: Sections 83 - 88)**

**UNIT - III: (18 hours)**

Integrals - derivatives of function  $w(t)$  - Definite Integrals – Contours - Contour Integrals - examples – upper bounds for moduli of contour integrals - Cauchy-Goursat Theorem(without proof) - simply and multiply connected domains (theorems without proof) - Cauchy integral formula - derivatives of analytic functions - Liouville's Theorem and the Fundamental Theorem of Algebra - maximum modulus principle.

**(Chapter 4: Sections 36 - 41, 44, 46 - 50)**

**UNIT-IV (18 hours)**

Series - convergence of sequences and series (theorems without proof) - Taylor series - examples - Laurent series - examples – residues - Cauchy's Residue Theorem - using a single residue - the three types of isolated singular points.

**(Chapter 5: Sections 51 - 56, Chapter 6: Sections 62 - 65)**

**UNIT - V: (18 hours)**

Residues at Poles – examples - zeros of analytic functions - zeros and poles evaluation of improper integrals – example - improper integrals from fourier analysis – Jordan's lemma – definite integrals involving sines and cosines.

**(Chapter 6: Sections 66 - 69, Chapter 7: Sections 71- 74 and 78)**

**Text Book:**

James Ward Brown, Ruel V. Churchill, Complex Variables and Applications (Seventh Edition), McGraw Hill Publishers, 2003.

**Reference Books:**

1. S. Ponnusamy, Foundations of Complex Analysis, second edition, Alpha science publications, 2011.
2. S. Arumugam, Thangapandi Issac and A. Somasundaram, Complex Analysis, Scitech publication, 2015.

**MECHANICS**  
**(Course Code: 23UMTC63)**

<b>Semester - VI</b>	<b>Core - T15</b>	<b>Hours - 6</b>	<b>Credits - 4</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Explain simple harmonic motion and seconds pendulum (K2)
- CO 2.** Describe the equilibrium of Strings and its applications (K2)
- CO 3.** Discuss the concepts of statics and dynamics (K2)
- CO 4.** Solve simple problems related to projectiles (K3)
- CO 5.** Demonstrate the laws of forces (K3)
- CO 6.** Apply Newton's laws in real life situations (K3)

**UNIT-I :** **(18 hours)**

Forces acting at a point - resultant and components - parallelogram of forces - triangle law of forces - Lami's theorem - applications.

**(Text book 1: Chapter 2)**

**UNIT – II:** **(18 hours)**

Equilibrium of Strings - the common catenary - approximations to the shape of the catenary - applications.

**(Text book 1: Chapter 11)**

**UNIT – III:** **(18 hours)**

Laws of motion - Newton's laws of motion - motion of a particle on a rough horizontal plane - pressure of a body - atwood's Machine - tension in an elastic string - work done – energies - applications.

**(Text book 2: Chapter 4)**

**UNIT – IV:** **(18 hours)**

Projectiles - the path of a projectile - characteristics of the motion of a Projectile - velocity of the projectile - range on an inclined plane - time of flight - motion on the surface of a smooth inclined plane - applications.

**(Text book 2: Chapter 6)**

**UNIT – V:** **(18 hours)**

Simple harmonic motion - simple harmonic motion in a straight line - general solution of the S.H.M equation - geometrical representation of a S.H.M - composition of two simple harmonic motion of the same period and in the same straight line - composition of two simple harmonic motion of the same period and in perpendicular directions - forces necessary to produce simple harmonic motion - motion of a particle suspended by a spiral spring - horizontal oscillations of a particle tied to an elastic string - simple pendulum - period of a oscillation of a simple pendulum - equivalent simple pendulum - applications.

**(Text book 2: Chapter 10)**

**Text Books:**

1. M. K. Venkataraman, Statics, Agasthiar Publications, Trichy, 1999.
2. M. K. Venkataraman, Dynamics, Agasthiar Publications, Trichy, 2001.

**Reference Books:**

1. Rajeswari, Mechanics, Saras publication, Nagercoil, 2016.
2. S. L. Kakani, C. Hemrajani and S. Kakani, Mechanics (Second edition), Viva Student edition, 2012.

# NUMERICAL METHODS

(Course Code: 23 UMTE 61)

Semester - VI	EC – T6	Hours - 5	Credits - 3
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**Course Outcomes:** By the end of course the students will be able to

**CO 1.** Recall the basics of numerical methods of differentiation and integration. (K1)

**CO 2.** Compute the roots of algebraic and transcendental equations using numerical methods.(K2)

**CO 3.** Solve the simultaneous equations using iterative methods.(K3)

**CO 4.** Calculate the derivatives and integration using numerical methods. (K3)

**CO 5.** Analyze the various interpolation of functions. (K4)

**CO 6.** Derive the solutions for differential equations. (K6)

**UNIT - I:** (15 hours)

Algebraic and transcendental equations - Introduction - errors in numerical computation - iteration method - bisection method - Regula-Falsi method - Newton-Raphson method.

(Chapter 3: Sections 3.0 - 3.5)

**UNIT - II:** (15 hours)

Introduction - simultaneous equations - back substitution - Gauss Elimination method -Gauss-Jordan elimination method - iterative methods – Gauss-Jacobi iteration method - Gauss-seidel iteration method

(Chapter 4: sections 4.0 - 4.4, 4.7 and 4.8)

**UNIT - III:** (15 hours)

Finite differences- introduction - difference operators - other difference operators – interpolation – introduction - Newton’s interpolation formulae - Lagrange’s interpolation formulae - divided differences - Newton’s divided differences formula.

(Chapter 6: Sections 6.0 - 6.2, Chapter 7: sections 7.0, 7.1, 7.3 - 7.5)

**UNIT - IV:** (15 hours)

Numerical Differentiation and Integration - Introduction - derivatives using Newton’s forward difference formula and Newton’s backward difference formula - derivatives using central difference formulae - numerical integration.

(Chapter 8: Sections: 8.0 - 8.3, 8.5)

**UNIT - V:** (15 hours)

Numerical solutions of Ordinary Differential Equations - Introduction - Taylor’s series method - Picard’s method - Euler’s method - Runge - Kutta methods – Predictor-corrector methods - Milne’s method.

(Chapter 10: Sections 10.0 - 10.6)

## Text Book:

S. Arumugam, A. Thangapandi Issac and A. Somasundaram, Numerical methods, Scitech Publications (India) Pvt Ltd, 2008.

## Reference Books:

1. Singaravelu. A, MA 1251 Numerical methods, Meenakshi academy, 2008.
2. Babu Ram, Numerical methods, Pearson, 2010.

## ASTRONOMY

(Course Code: 23 UMTE 61)

Semester - VI	EC – T6	Hours - 5	Credits - 3
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**Course outcomes:** By the end of the course the students will be able to

**CO 1.** Recall the celestial bodies and celestial coordinates (K1)

**CO 2.** Describe Kepler's laws (K2)

**CO 3.** Associate the solar and lunar eclipses (K2)

**CO 4.** Apply the Kepler's laws in Newton deductions (K3)

**CO 5.** Analyze the seasons and calendar (K4)

**CO 6.** Build the knowledge of astro-physics (K6).

**UNIT - I:** (15 hours)

Celestial sphere and diurnal motion – Celestial coordinates - Sidereal time.

(Art. 39 – 76)

**UNIT - II:** (15 hours)

Morning and evening stars – circumpolar stars - zones of earth - perpetual day - twilight.

(Art. 80 – 83, 87 – 89, 111 – 116)

**UNIT - III:** (15 hours)

Refraction – laws of refraction – tangent formula - horizontal refraction - geocentric parallax – horizontal parallax.

(Art. 117 – 128, 135 – 144)

**UNIT - IV:** (15 hours)

Kepler's laws - Anomalies – Kepler's equation - Calendar.

(Art. 146 – 149, 156 – 159, 175 – 179)

**UNIT - V:** (15 hours)

Moon - sidereal and synodic months – elongation – phase of moon – eclipses - umbra and penumbra – lunar and solar eclipses – maximum and minimum number of eclipses in a year.

(Art. 229 – 241, 256 – 263, 267, 268, 271 – 275)

### Text Book:

S. Kumaravelu and SusheelaKumaravelu, Astronomy, Janki Calendar Corporation, Sivakasi, 2012.

### Reference Books:

1. S.K.Sharma, R.K. Gupta and Dharendra Kumar, Spherical Astronomy, Krishna Prakashan Media (P) Ltd, Meerut, 2014.
2. W M Smart, A Text Book on Spherical Astronomy, 6th edition, revised by R.M. Green, Cambridge University Press, 1977.

# DISCRETE MATHEMATICS

(Course Code: 23UMTE61)

Semester - IV	EC – T6	Hours - 5	Credits - 3
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Identify the applications of Pascal's triangle (K1)
- CO 2.** Summarize the combinatorial tools (K2)
- CO 3.** Discuss the Euclidean Algorithm (K2)
- CO 4.** Use combinatorial concepts in Computer Applications (K3)
- CO 5.** Argue the laws of large and small numbers (K5)
- CO 6.** Compare number theory and combinatorics (K5)

**UNIT - I:** (15 Hours)

Combinatorial tools –induction - comparing and estimating numbers - inclusion-exclusion - the twin Paradox - the good old Logarithm.

(Chapter 2: Sections 2.1 – 2.3 and 2.5)

**UNIT - II:** (15 Hours)

Binomial Coefficients - the binomial theorem - Pascal's triangle - identities in Pascal's triangle - a bird's eye view of Pascal's triangle.

(Chapter 3: Sections 3.1, 3.5-3.7)

**UNIT - III:** (15 Hours)

Fibonacci Numbers – Fibonacci's exercise - lots of Identities - a formula for the Fibonacci numbers - combinatorial probability - the law of large Numbers - the law of small numbers.

(Chapter: 4, Chapter 5: Sections 5.3 and 5.4)

**UNIT - IV:** (15 Hours)

Integers - divisors and primes - divisibility of integers – primes - factorization into primes - Fermat's little theorem.

(Chapter 6: Sections 6.1- 6.3 and 6.5)

**UNIT - V:** (15 Hours)

The Euclidean Algorithm – congruences - number theory and Combinatorics - testing Prime

(Chapter 6: Sections 6.6, 6.7, 6.9 and 6.10)

## Text Book:

L. Lovasz, J. Pelikan, K. Vesztergombi, Discrete Mathematics - Elementary and Beyond, Springer-Verlag, New Delhi, 2003.

## Reference Books:

1. Richard Johnsonbaugh, Discrete Mathematics, sixth edition, Pearson, 2008.
2. Seymour Lipschutz, Marc Laras Lipson, Varsha H. Patil, Discrete Mathematics, Schaum's outline series, 2017.

# INTRODUCTION TO MACHINE LEARNING THEORY

(Course Code : 23UMTE61)

Semester – VI	EC-T6	Hours - 3	Credits – 3
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the basics of R data structures. (K1)
- CO 2. Explain the different type of learning. (K2)
- CO 3. Apply notions to Machine Learning. (K3)
- CO 4. Analyze the dataset using cluster analysis. (K4)
- CO 5. Evaluate the concept of Tree and Probabilistic Model. (K5)
- CO 6. Compare Machine Learning in R with Spark - Machine Learning in R with H<sub>2</sub>O (K5)

**UNIT - I:** (15 hours)

Introducing Machine Learning: The origins of machine learning - uses and abuses of machine learning - How machines learn - Machine learning in practice - Machine learning with R

(Text Book 1, Chapter – 1)

**UNIT – II:** (15 hours)

Managing and Understanding Data: R Data Structures - Managing data with R - Exploring and understanding data

(Text Book 1, Chapter - 2)

**UNIT – III:** (15 hours)

Machine Learning Theory and Practice: Machine Learning Types - Groups of Machine Learning Algorithms - Regression Analysis - Correlation Analysis

(Text Book 2, Chapter – 6 (6.1, 6.2, 6.4, 6.5))

**UNIT – IV:** (15 hours)

Support Vector Machine SVM - Decision Trees - The Naive Bayes Method - Cluster Analysis

(Text Book 2, Chapter – 6 (6.6-6.9))

**UNIT – V:** (15 hours)

Scalable Machine Learning and Related Technologies: Distributed Processing and Storage - The Hadoop Ecosystem - Machine Learning in R with Spark - Machine Learning in R with H<sub>2</sub>O

(Text Book 2, Chapter – 10)

**Text Book:**

1. Brett Lantz, Machine Learning with R - Second Edition, Packt Publisher, 2015.
2. Karthik Ramasubramanian and Abhishek Singh, Machine Learning Using R, Apress Berkeley, CA 2019

# INTRODUCTION TO MACHINE LEARNING PRACTICAL

(Course Code : 23UMTE61)

Semester – VI	EC-T6	Hours - 2	Credits – 3
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recall the basics of data structures. (K1)
- CO 2.** Explain the different type of analysis. (K2)
- CO 3.** Apply functions to data visualization. (K3)
- CO 4.** Analyze the dataset using cluster analysis. (K4)
- CO 5.** Evaluate the concept of ML in R with spark and R with H2O. (K5)
- CO 6.** Create Artificial Neural Networks. (K6)

## Program List

1. Creating Data Structures
2. Manage, Explore and Understanding Data
3. Data Visualization
4. Probability Distributions
5. Correlation and Regression Analysis
6. Decision Trees
7. Cluster Analysis
8. Artificial Neural Networks
9. ML in R with Spark
10. ML in R with H2O

## Reference Book:

Karthik Ramasubramanian and Abhishek Singh, Machine Learning Using R,  
Apress Berkeley, CA 2017



# INTRODUCTION TO DATA SCIENCE THEORY

(Course Code : 23UMTE61)

<b>Semester – VI</b>	<b>EC-T6</b>	<b>Hours - 3</b>	<b>Credits – 3</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recall the basics of data operations. (K1)
- CO 2.** Explain the exploratory data analysis. (K2)
- CO 3.** Apply basic machine learning algorithms. (K3)
- CO 4.** Analyze the dataset using linear regression. (K4)
- CO 5.** Evaluate the network analysis. (K5)
- CO 6.** Analyze regression (K4)

**UNIT – I:** **(15 hours)**

Introduction, Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.

**(Ch: 1,2)**

**UNIT – II:** **(15 hours)**

Descriptive statistics, data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, hypothesis testing using confidence intervals, using p-values

**(Ch: 3,4)**

**UNIT – III:** **(15 hours)**

Supervised Learning: First step, learning curves, training-validation and test. Learning models generalities, support vector machines, random forest. Examples

**(Ch: 5)**

**UNIT – IV:** **(15 hours)**

Regression analysis: linear regression simple linear regression, multiple & Polynomial regression, Sparse model.

**(Ch: 6)**

**UNIT – V:** **(15 hours)**

Unsupervised learning: clustering, similarity and distances, quality measures of clustering, case study.

**(Ch: 7)**

**Text Book:**

Laura Igual and SantiSeguí, Introduction to Data Science a Python approach to concepts, Techniques and Applications, Springer, 2017

**Reference Book:**

1. Data Analysis with Python A Modern Approach, David Taieb, Packt Publishing, ISBN: 9781789950069
2. Python Data Analysis, Second Ed., Armando Fandango, Packt Publishing, ISBN: 9781787127487

# INTRODUCTION TO DATA SCIENCE PRACTICAL

(Course Code : 23UMTE61)

Semester – IV	EC-T6	Hours - 2	Credits – 3
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the basics libraries. (K1)
- CO 2. Explain the different type of analysis. (K2)
- CO 3. Apply functions to data visualization. (K3)
- CO 4. Analyze the dataset using cluster analysis. (K4)
- CO 5. Evaluate the concept using regression methods. (K5)
- CO 6. Create the new networks. (K6)

## Program List

1. Implementation of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
2. Implementation of Python Libraries for ML application such as Pandas and Matplotlib.
3. Creation and loading different datasets in Python and compute Mean, Median, Mode, Variance, Standard Deviation using datasets.
4. Compute reshaping the data, filtering the data, merging the data and handling the missing values in datasets.
5. Compute the Simple Linear Regression and plot the graph.
6. Implementation of Naviebayes classifier algorithm and plot the graph.
7. Implementation of SVM classification and plot the graph.
8. Implementation of k-means clustering.
9. Implementation of hierarchical clustering.
10. Performance analysis on a specific dataset.

## TECHNIQUES IN REASONING

(Course Code: 23UMTS61)

Semester - VI	SEC - 8	Hours - 2	Credits -2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Explain the concept of coding and decoding (K2)
- CO 2. Use the analytical thinking in various situations (K3)
- CO 3. Analyze the given series of data (K4)
- CO 4. Select the figures to complete given pattern (K5)
- CO 5. Develop the mental ability and power of reasoning (K6)
- CO 6. Develop the competency to face competitive examinations (K6)

**Eligibility:** Mathematics major students only.

### VERBAL REASONING

**UNIT- I:** (6 hours)

Series completion – analogy – coding -de coding.

(Part I: Section I: Chapters 1, 2 and 4)

**UNIT- II:** (6 hours)

Blood relations - alphabet test - inserting the missing character.

(Part I: Section I: Chapters 5, 10 and 16)

**UNIT- III:** (6 hours)

Direction sense test – alpha numeric sequence - mathematical operations.

(Part I: Section I: Chapters 8,11 and 13)

### NON-VERBAL REASONING

**UNIT- IV:** (6 hours)

Series completion - mirror images - water images - spotting out the embedded figures.

(Part II: Chapters 1, 5, 6 and 7)

**UNIT- V:** (6 hours)

Completion of incomplete pattern - figure matrix - cubes and dice - dot situation.

(Part II: Chapters 8, 9, 14 and 15)

### Text Book:

R.S. Aggarwal, A modern approach to verbal and non-verbal reasoning, S. Chand and Company Ltd, Ram Nagar, New Delhi.

### Reference Book:

J. K Chopra, Reasoning and Aptitude test, Unique Publishers, 2012.

**ADD ON COURSE**  
**MATHEMATICAL QUOTIENT**  
**(Course Code: 23UMTAO1)**

<b>Credits-2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Describe the specific knowledge of profit and loss(K1)
- CO 2.** Explain the concepts of pipes and cisterns (K2)
- CO 3.** Solve problems related to time and distance. (K3)
- CO 4.** Analyze the concepts of Time and Work (K4)
- CO 5.** Evaluate the data interpretation problems (K5)
- CO 6.** Build the mental ability to face the competitive examination (K6)

**Eligibility:** For all I B.Sc. Mathematics students

**UNIT- I:** **(6 hours)**

Problems on Ages – Profit and Loss.

**(Sec I: Chapter 8, 12)**

**UNIT- II:** **(6 hours)**

Time and Work – Time and Distance.

**(Sec I: Chapter 17, 18)**

**UNIT -III:** **(6 hours)**

Ratio and Proportion – Partnership.

**(Sec I: Chapter 13, 14)**

**UNIT- IV:** **(6 hours)**

Pipes and Cisterns – Boats and Streams.

**(Sec I: Chapter 16, 19)**

**UNIT -V:** **(6 hours)**

Data Interpretation: Tabulation – Bar graphs.

**(Sec II: Chapter 36, 37)**

**Text Book:**

Dr. R. S. Aggarwal, Quantitative Aptitude, Revised Edition 2022.

**Reference Book:**

Manhattan PRE, Book of GRE Practice problems, 2nd Edition, World Class Instructors, Proven Results. (Online Resources)

**VALUE ADDED COURSE**  
**MATHEMATICAL APTITUDE**  
**(Course Code: 23UMTCC1)**

<b>Credits-2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Describe the specific knowledge of square roots and cube roots (K1)
- CO 2.** Explain the concepts of surds and indices (K2)
- CO 3.** Evaluate the data interpretation problems. (K5)
- CO 4.** Analyze the concepts of banker's discount and true discount (K4)
- CO 5.** Compare between the simple interest and compound interest (K5)
- CO 6.** Build mental ability to approach the competitive examination (K6)

**Eligibility :** For all II B.Sc. Mathematics students

**UNIT - I:** **(6 hours)**

Square roots and Cube roots - Average

**(Chapters 5 and 6)**

**UNIT- II:** **(6 hours)**

Surds and Indices - Percentage.

**(Chapters 9 and 11)**

**UNIT- III:** **(6 hours)**

Simple Interest - Compound Interest

**(Chapters 21 and 22)**

**UNIT- IV:** **(6 hours)**

True Discount – Banker's Discount

**(Chapters 32 and 33)**

**UNIT- V:** **(6 hours)**

Data Interpretation: Pie Chart – Line Graphs

**(Chapters 38 and 39)**

**Text Book:**

R.S. Aggarwal, Quantitative Aptitude for competitive Examinations, S. Chand and company Ltd., 2017.

**Reference Books:**

1. Topic-wise solved papers for IBPS/SBI Bank PO/ Clerk prelims and Mains (Quantitative Aptitude – 2010-16), Disha publication.
2. P. Gupta, Quantitative Aptitude, Unique publishers.
3. Manhattan PRE, Book of GRE Practice problems, 2nd Edition, World Class Instructors, Proven Results. (Online Resources)

# TRAINING FOR JAM EXAMINATION

(Course Code: 23UMTCC2)

Credits-2

**Course Outcomes:** By the end of the course the students will be able to:

- CO 1. Identify the problems in algebra and analysis (K1)
- CO 2. Discuss the concepts in algebra and linear algebra (K2)
- CO 3. Determine the techniques for solving problems (K3)
- CO 4. Classify methods for solving problems (K4)
- CO 5. Evaluate the integral equations (K5)
- CO 6. Build the mental ability to face the competitive examination. (K6)

**Eligibility:** For all II B.Sc. Mathematics students

**UNIT - I: (6 hours)**

Sequences and Series of Real numbers: Convergence of sequences, bounded and monotone sequences, Cauchy sequences, Bolzano-Weierstrass theorem, absolute convergence, tests of convergence for series- comparison test, root test, power series (of one real variable), radius and interval of convergence, term-wise differentiation and integration of power series.

**UNIT - II: (6 hours)**

Functions of one real variable: limit, continuity, intermediate value property, differentiation, Rolle's theorem, mean value theorem, L'Hospital's rule, Taylor's theorem, Taylor's series, maxima and minima, Riemann integration (definite integrals and their properties), fundamental theorem of calculus.

**UNIT - III: (6 hours)**

Functions of two or three variables: limit, continuity, partial derivatives, total derivative, maxima and minima.

Integral Calculus: double and triple integrals, change of order of integration, calculating surface areas and volumes using double integrals, calculating volumes using triple integrals.

**UNIT - IV: (6 hours)**

Differential Equations: Bernoulli's equation, exact differential equations, integrating factors, orthogonal trajectories, homogeneous differential equations, method of separation of variables, linear differential equations of second order with constant coefficients, method of variation of parameters, Cauchy-Euler equation.

Matrices: Systems of linear equations, rank, nullity, rank-nullity theorem, inverse, determinant, eigenvalues, eigenvectors.

**UNIT - V: (6 hours)**

Finite Dimensional Vector Spaces: Linear independence of vectors, basis, dimension, linear transformation, matrix representation, range space, null space.

Groups: Cyclic groups, abelian groups, non-abelian groups, permutation groups, normal subgroups, quotient groups, Lagrange's theorem for finite groups, group homomorphisms.

**Text Book:**

Previous year JAM Mathematics Question papers.

Ref: [https://jam.iitm.ac.in/Test\\_Paper.php](https://jam.iitm.ac.in/Test_Paper.php)

## EXTRA CREDIT COURSES

### R PROGRAMMING

(Course Code: 23UMTEC1)

Semester – II	ECC (Self Study)	Credits –2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Recall the basics of R programming (K1)
- CO 2. Explain how to use R for statistical programming, computation, graphics, and modeling (K2)
- CO 3. Apply functions to Matrix Rows and Columns (K3)
- CO 4. Outline simulation programming in R (K4)
- CO 5. Create Data Frames (K6)
- CO 6. Develop R programs for the given task(K6)

#### UNIT - I:

**Gaining started** - Introduction to Functions - Important R Data Structures - Gaining Help - vectors - Declarations - Common Vector Operations - Using all() and any() - Vectorized Operations - NA and NULL Values

#### UNIT - II:

**Filtering** - The Selection Function which() - The ifelse() Function - Vector Element Names - Matrices and Arrays - General Matrix Operations - Filtering on Matrices - Applying Functions to Matrix Rows and Columns - Adding and Deleting Matrix Rows and Columns - More on the Vector/Matrix Distinction - Higher-Dimensional Arrays - Lists - Creating Lists - General List Operations - Accessing List Components and Values - Applying Functions to Lists - Recursive Lists.

#### UNIT – III:

**Data frames** - Creating Data Frames - Other Matrix-Like Operations - Merging Data Frames - Applying Functions to Data Frames - Factors and Tables - Factors and Levels - Common Functions Used with Factors

#### UNIT – IV:

**Working with Tables** - Other Factor- and Table-Related Functions - R Programming Structures - Control Statements - Arithmetic and Boolean Operators and Values - Default Values for Arguments - Return Values - Functions Are Objects - Environment and Scope Issues - No Pointers in R - Writing Upstairs - Recursion - Replacement Functions - Anonymous Functions

#### UNIT – V:

**Doing Math and Simulations in R** - Math Functions - Functions for Statistical Distributions - Sorting - Linear Algebra Operations on Vectors and Matrices - Set Operations - Simulation Programming in R.

### **Practical List:**

1. Write a program that prints 'Hello World' to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Implement the following sorting algorithms: Selection sort, Insertion sort, Bubble Sort
7. Implement matrices addition, subtraction and Multiplication

### **Text Book:**

Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.

### **Reference Books:**

1. Michael J. Crawley, "The R Book", John Wiley & Sons Ltd, 2007.
2. Jared P. Lander, "R for Everyone", Pearson Education, Inc., 2014.



**DATA ANALYTICS**  
**(Course Code: 23UMTEC2)**

<b>Semester – III</b>	<b>ECC (Self Study)</b>	<b>Credits - 2</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recall the basics of Statistics and Data Analysis (K1)
- CO 2.** Recall the fundamentals of Python (K1)
- CO 3.** Describe the types of data visualization (K2)
- CO 4.** Apply classification techniques in Data Analytics (K3)
- CO 5.** Outline Challenges for Big Data Analytics (K4)
- CO 6.** Summarize Data Analytics for Pharmaceutical Discoveries (K5)

**UNIT- I:**

***Data collection and management:*** Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources; ***Data Analysis:*** Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

**(Textbook – 1, Chapters: 1 - 3 & Textbook – 2, Chapters: 1 - 3)**

**UNIT- II:**

***Machine Learning:*** Introduction and Concepts, Differentiating algorithmic and model-based frameworks; ***Regression:*** Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbour, Regression & Classification; ***Data Visualization:*** Introduction, Types of Data Visualization, Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

**(Textbook – 2, Chapter: 4, Textbook – 3, Chapter: 3, 9)**

**UNIT- III:**

***Supervised Learning with Regression and Classification Techniques -1:*** Bias-Variance, Dichotomy Model, Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines. ***Supervised Learning with Regression and Classification techniques -2:*** Ensemble Methods: Random Forest Neural Networks Deep learning.

**(Textbook – 4, Chapters: 4 - 5)**

**UNIT- IV:**

***Unsupervised Learning and Challenges for Big Data Analytics:*** Clustering, Associative Rule Mining, Challenges for big data analytics. ***Prescriptive Analytics:*** Creating data for analytics through designed experiments, Creating data for analytics through Active Learning, Creating data for analytics through Reinforcement learning. ***Introduction to Python Packages:*** Fundamentals of Python, Inserting and Exporting Data, Data Cleansing, Checking and Filling Missing Data, Merging Data, Operations, Joins.

**(Textbook – 4, Chapters: 1 - 3)**

**UNIT- V:**

***Applications of Data Analytics:*** Technologies for visualization, Bokeh (Python), recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data analytics. ***Applications and***

**Practical Systems for Healthcare:** Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.

(Textbook – 5, Part – 1 and Part – 2)

**Text Books:**

1. Roger Sapsford and Victor Jupp, “Data collection and analysis”, SAGA publisher, 2nd Edition, 2003.
2. Introduction to Data Science, Davy Cielen, Arno D B Meysman and Mohamed Ali, Manning, dreamtech press.
3. E. Alpaydin, “Introduction to Machine Learning”, 2nd Edition, MIT Press, 2010.
4. Hefin I. Rhys, “Machine learning with R, the tidyverse, and mlr, e-book, online, MANNING Publisher, 2020.
5. Hui Yang and Eva K. Lee, “Healthcare Analytics: From Data to Knowledge to Healthcare Improvement”, Wiley, 2016.

**Reference Books:**

1. Hastie, Trevor, et al., “The elements of statistical learning”, Vol. 2. No.1, New York: Springer, 2009.
2. Samir Madhavan., “Mastering Python for Data Science”, Packt, 2015.
3. Mark Lutz., “Learning Python” O’Reilly, 5th Edition, 2013.
4. Tiffany Bergin, “An Introduction to Data analysis – Quantitative, Qualitative and Mixed Models”, SAGA Publisher, 2018
5. ShaiShalev-Shwartz, Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014.

# STATISTICAL METHODS

(Course Code: 23UMTEC3)

Semester – IV

ECC (Self Study)

Credits - 2

**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Explain the concept of sampling design and methods (K2)
- CO 2. Discuss the rules and types of classification (K2)
- CO 3. Apply various statistical tools for solving real life problems (K3)
- CO 4. Analyze the primary and secondary data (K4)
- CO 5. Classify diagrammatic representation and graphic presentation (K4)
- CO 6. Design questionnaire for collecting data (K6)

**Eligibility:** For all UG students

## UNIT - I: Collection of Data

Primary and Secondary Data, Direct Personal Observation, Indirect Oral Interview, Information Through Agencies, Mailed Questionnaires, Schedules sent through Enumerators, Sources of Secondary Data, Precautions in the use of Secondary Data, Framing Questionnaires, Theoretical Questions.

(Chapter 4)

## UNIT - II: Sampling Design

Finite and infinite population. Hypothetical and Existent Population, Census method, Sample Method, Essentials of Sampling. Methods of sampling, Random Sampling method, Non-Random Sampling, Simple Random Sampling, Restricted Random Sampling, Stratified Sampling, Systematic Sampling, Cluster Sampling, Judgement Sampling, Quota Sampling, Convenience or churk Sampling, Statistical laws, The Law of Statistical regularity, The Law Inertia of Large Numbers, Statistical Error, Measurement of Errors, Test of Reliability of Samples, Theoretical Questions.

(Chapter 5)

## UNIT - III: Classification and Tabulation

Introduction, Meaning of Classification, Chief Characteristics of Classification, objects of Classification, Rules of Classification, Types of Classifications, Geographical Classification, Chronological Classification, Qualitative Classification, Quantitative Classification, Statistical Series, Types of Series ,Frequency Distribution, Continuous Frequency Distribution, class frequency, Magnitude of class Intervals, Cumulative Frequency Distribution, Two-way Frequency Distribution, Tabulation of data, Meaning, objects, Difference between Classification and Tabulation, Parts of tabulation, Structure of Tabulation, Rules for Tabulation, Types of tables, On the basis of Originality, Illustration, Theoretical Questions, Practical Problems.

(Chapter 6)

## **UNIT - IV: Diagrammatic Representation**

Limitations of a diagram, rules for making a diagram, types of diagram, one dimensional diagram, twodimensional diagram (Area of surface diagram), threedimensional diagram, Pictogram, cartogram, choice or selection of a diagram, Theoretical questions, practical problems.

**(Chapter 7)**

## **UNIT - V: Graphic Presentation**

Advantages of Graphic Presentation, Construction of a graph, General Rules, Difference Between Diagram and graph, Graph of Frequency Distribution: Histogram, Frequency Polygon, Frequency Curve, Ogive or Cumulative Frequency Curves, more than Ogive, Graph of Time Series: Horizontal Line Graph of Histogram, False Base lines, Silhouette (Net Balance Graph) Range of Variation Graph, Component or Band Graph, Z Curve, Theoretical Questions.

**(Chapter 8)**

### **Text Book:**

R. S. N, Pillai and Bagavathi, Statistics, Theory and Practice, S. Chand and Company Ltd, 2013.

### **Reference Book:**

S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11<sup>th</sup> Edition, Sultan Chand and Sons, 1982.

# QUANTITATIVE APTITUDE

(Course Code: 23UMTEC4)

Semester – V	ECC (Self Study)	Credits - 2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Explain the concepts of coding, decoding and ranking tests (K2)
- CO 2.** Discuss the problems on digit aptitude (K2)
- CO 3.** Apply the number analogy test to solve problems(K3)
- CO 4.** Solve the problems on date, calendar and clock (K3)
- CO 5.** Evaluate the problems on permutations and combinations(K5)
- CO 6.** Develop the reasoning ability(K6)

**Eligibility:** For all UG students (Compulsory for V semester Mathematics students)

## Unit - I:

Coding – Decoding Test - Direction Sense Test.

(Text Book 1: Chapters 2 and 3)

## Unit - II:

Ranking Test - Seating Arrangement Test – Date, Calendar and Clock - Mathematical operations – Mathematical problems.

(Text Book 1: Chapters 5, 6, 7, 8 and 9)

## Unit - III:

Analogy – Dice – Number Analogy Test – Matrix.

(Text Book 1: Chapters 12, 13, 14 and 15)

## Unit - IV:

Puzzle Test – Inequality – Digit Aptitude.

(Text Book 1: Chapters 22, 23 and 24)

## UNIT - V;

Permutations and Combinations – Probability – True Discount – Banker's Discount – Heights and Distances – Odd man out & Series.

(Text Book 2: Chapters 30, 31, 32, 33, 34 and 35)

## Text Books:

1. Dr. Lal, Mishra & Kumar, Multi-Dimensional Reasoning (Verbal and Non-Verbal), UpkarPrakashan, Agra,
2. Dr. R. S. Aggarwal, Quantitative Aptitude (for competitive examinations), S. Chand and company Limited, 2017

## Reference Book:

U.Mohan Rao, Quantitative Aptitude (For Competitive Examinations), Scitech Publications (India) Pvt, Ltd, Chennai, 2012.

# HISTORY OF MATHEMATICS

(Course Code: 23UMTEC5)

Semester – VI	ECC (Self Study)	Credits - 2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Acquire the knowledge in history of mathematics (K1)
- CO 2.** Understand how the ancient mathematicians worked together as a team to develop mathematical research (K2)
- CO 3.** Classify the history of mathematics through the time of its invention (K3)
- CO 4.** Identify significant role of mathematician in human development and promoting social harmony and analyze how the mathematical research was developed over the period of time (K4)
- CO 5.** Assess creative and flexible thinking by studying historical evidence that there are different ways to view a mathematical concept (K5)

**Eligibility:** For all UG students

## UNIT- I:

Isaac (Sir) Newton 1642-1727) England- Archimedes of Syracuse (287-212 BC) Greek domain- Johann Carl Friedrich Gauss (1777-1855) Germany - Leonhard Euler (1707-1783) Switzerland- Georg Friedrich Bernhard Riemann (1826-1866) Germany- Joseph-Louis (Comte de) Lagrange (1736-1813) Italy, France - Euclid of Alexandria (ca 322-275 BC) Greece/Egypt- David Hilbert (1862-1943) Prussia, Germany- Gottfried Wilhelm von Leibniz (1646-1716) Germany.

## UNIT – II:

Pierre de Fermat (1601-1665) France- Évariste Galois (1811-1832) France-René Descartes (1596-1650) France- Johann Peter Gustav Lejeune Dirichlet (1805-1859) Germany- SrinivasaRamanujanIyengar (1887-1920) India- Carl G. J. Jacobi (1804-1851) Germany- Brahmagupta ‘Bhillamalacarya’ (589-668) Rajasthan (India).

## UNIT – III:

Georg Cantor (1845-1918) Russia, Germany -Augustin-Louis Cauchy (1789-1857) France Arthur Cayley (1821-1895) England – Pythagoras of Samos (ca 578-505 BC) Greek domain - Aryabhata (476-550) Ashmaka&Kusumapura (India) - Leonardo ‘Bigollo’ Pisano (Fibonacci) (ca 1170-1245) Italy - William Rowan (Sir) Hamilton (1805-1865) Ireland - Diophantus of Alexandria (ca 250) Greece, Egypt.

## UNIT–IV:

BhāscaraĀchárya (1114-1185) India - Jean-Baptiste le Rond’ Alembert (1717-1783) France - Joseph Liouville (1809-1882) France - Ferdinand Gotthold Max Eisenstein (1823-1852) Germany - Jacob Bernoulli (1654-1705) Switzerland - Johannes Kepler (1571-1630)

Germany - Jacques Salomon Hadamard (1865-1963) France - Jean Baptiste Joseph Fourier (1768-1830) France.

**UNIT – V:**

Albert Einstein (1879-1955) Germany, Switzerland, U.S.A. - Galileo Galilei (1564-1642) Italy - Henri Léon Lebesgue (1875-1941) France - Johann Bernoulli (1667-1748) Switzerland – Felix Hausdorff (1868-1942) Germany - George Pólya (1887-1985) Hungary - Siméon Denis Poisson (1781-1840) France -Adrien Marie Legendre (1752-1833) France.

**Text Book:**

<http://fabpedigree.com/james/mathmen.htm#>

**Reference Books**

1. C.B. Boyer and U. Merzbach, History of Mathematics, John Wiley & Sons, 3rd edition, 2011.
2. E.T. Bell, Men of Mathematics, Published by Simon & Schuster, 1986.

**EXTRA CREDIT COURSES FOR OTHER MAJOR STUDENTS**  
**SET THEORY**  
**(Course Code: 23UMTEC6)**

**Semester II**

**ECC (Self Study)**

**Credits - 2**

**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** List out the sets and the operations on sets (K1)
- CO 2.** Discuss the equivalence relations (K2)
- CO 3.** Examine the knowledge of functions and binary operations (K3)
- CO 4.** Apply the law of trichotomy and the properties of numbers to solve problems (K3)
- CO 5.** Analyze the number system and well ordering principle (K4)
- CO 6.** Create confidence to face the competitive examination (K6)

**Eligibility:** All UG students except from the Department of Mathematics

**UNIT - I:**

Sets - operation on sets – union – intersection – difference - complement of a set - symmetric difference.

**(Chapter 1: Sections 1.1 - 1.7)**

**UNIT - II:**

Cartesian product - relations - equivalence relations - partial order.

**(Chapter 1: Section 1.8, Chapter 2:  
Sections 2.1 - 2.3)**

**UNIT - III:**

Functions - Binary operations

**(Chapter 2: Sections 2.4 - 2.5)**

**UNIT - IV:**

Number systems - Peano's postulates - addition and multiplication in  $N$  - Properties- order in  $N$  - law of trichotomy - well ordering principle.

**(Chapter 3: Sections 3.0-3.1)**

**UNIT - V:**

The integers - addition and multiplication properties - order relation in  $Z$ - Identification of positive integers with natural numbers - Divisibility in  $Z$ .

**(Chapter 3: Sections 3.2 - 3.3)**

**Text Book:**

Dr. S. Arumugam and A. Thangapandi Issac, Set theory, Number system and Theory of Equations, New gamma Publishing house.

**Reference Books:**

1. S.B.Malik, Basic Number Theory, Vikas Publishing House Private Limited, Reprint 2006.
2. Daniel W. Cunningham, Set Theory, A first course.



# ANALYTICAL GEOMETRY OF TWO DIMENSIONS

(Course Code: 23UMTEC7)

Semester - III	ECC (Self Study)	Credits - 2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recollect the properties of straight lines and circles (K1)
- CO 2.** Discuss the role of transformations and invariants (K2)
- CO 3.** Discuss the concepts of polar system and conic sections (K2)
- CO 4.** Solve problems using tangents and normals (K3)
- CO 5.** Categorize the conics (K4)
- CO 6.** Develop the skill to face competitive examination (K6)

**Eligibility:** All UG students except from the Department of Mathematics

## UNIT - I: METRIC PROPERTIES IN PLANE

Fundamental notions - transformations and invariants - Examples

(Chapter 1: Sections 1.1 - 1.2)

## UNIT - II: STRAIGHT LINES IN PLANE

Different forms - A point in relation to a straight line - Pair of Straight lines

(Chapter 2: Sections 2.1 - 2.3)

## UNIT - III: CIRCLES IN PLANE

Different forms - A point in Relation to a Circle - A line in Relation to a circle.

(Chapter 3: Sections 3.1- 3.3)

## UNIT - IV:

Tangents and normals - Pole and Polar - System of Circles.

(Chapter 3: Sections 3.4 - 3.6)

## UNIT - V:

Some Fundamental Notions – Parabola – Ellipse – Hyperbola.

(Chapter 4: Section 4.1- 4.4)

## Text Book:

D. Chatterjee, Analytical geometry of Two Dimension, Narosa publishing House, 1999.

## Reference Book:

K.C.Mathew, S.Veeraraghavan and T.Raghavan, A Text Book of Co-ordinate Geometry of two and three dimensions, S.Chand and Company (Pvt), LTD, 1988.

# PYTHON

(Course Code: 23UMTEC8)

Semester IV	ECC (Self Study)	Credits - 2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1. Identify the errors in the given program (K1)
- CO 2. Describe the basic operations in python programming (K2)
- CO 3. Apply the decision making and looping statements (K3)
- CO 4. Break down a program in to smaller functions (K4)
- CO 5. Select the tools to write the given program (K4)
- CO 6. Develop a python program for the given real time problem (K6)

**Eligibility:** All UG students except from the Department of Mathematics

## UNIT - I:

**Data types in python:** Comments in python-Docstrings-How python sees variables – Data types in Python – Built-in data types-Bool Data type – Sequences in python-Sets – Literals in python – Determining the data type of a variable – What about characters – User-defined data types – Constants in python – Identifiers and Reserved words – Naming conventions in python.

(Chapter 3)

## UNIT - II:

**Operators in Python:** Operator - Arithmetic operators – Assignment operators – Unary minus operator – Relational operators – Logical operators – Boolean operators – Bitwise operators – Membership operators – Identity operators – Operator precedence and Associativity – mathematical Functions.

(Chapter 4)

**Input and Output:** Output statements – Input statements.

(Chapter 5)

## UNIT - III:

**Control statements:** Control statements – The if statement – A word on indentation – The if...else statement – The if...elif...else statement- The while loop – The for loop – Infinite loops – Nested loops – The else suite – The break statement – The continue statement – The pass statement – The assert statement – The return statement

(Chapter 6)

## UNIT - IV:

**Strings and Characters:** Creating strings – Length of a string – Indexing in strings – Slicing the strings – Repeating the strings – Concatenations of strings – Checking membership – Comparing strings.

**Functions:** Difference between a function and a method – Defining a function – Calling a function – Returning results from a function – Returning multiple values from a function – Functions are first class objects – Pass by object reference – Formal and actual arguments – Positional arguments – Keyword arguments – Default arguments – Variable

length arguments – Local and global variables – The global keyword – Passing a group of elements to a function – Recursive functions .

(Chapter: 8, 9)

#### UNIT - V:

**Lists and Tuples:** List – Creating lists using range() function – Updating the elements of a list – Concatenation of two lists – Repetition of lists – Membership in lists – Aliasing and cloning lists – Methods to process lists – Finding biggest and smallest elements in the list – Sorting the list elements – Number of occurrences of an element in the list – Finding common elements in two lists – Storing different types of data in a list – Tuples – Creating tuples – accessing the tuple elements – Basic operations on tuples – Functions to process tuples.

(Chapter 10)

**Dictionary:** Operations on dictionaries – Dictionary methods – Using for loop with dictionaries.

(Chapter 11)

#### Text Book:

Dr. R. Nageswara Rao, Core python programming, Second edition, Dreamtech press, 2018.

#### Reference Books:

1. Joseph Joyner, Python programming for beginners (Python programming language tutorial), Kindle edition.
2. Allen Downey, Jeffrey Elkner, Chris Meyers, Learning with Python, dream tech press, 2015.

# CLASSICAL ALGEBRA

(Course Code: 23UMTEC9)

Semester V	ECC (Self Study)	Credits - 2
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Describe exponential theorem and its applications (K1)
- CO 2.** Discuss the binomial and the logarithmic series and their applications (K2)
- CO 3.** Discuss the increase or decrease of the root by a given number (K2)
- CO 4.** Demonstrate Descartes's rule of signs (K3)
- CO 5.** Analyze the relation between roots and coefficients (K4)
- CO 6.** Create efficiency to face competitive examinations (K6)

**Eligibility:** For all major students except mathematics major students.

**Unit - I:**

Binomial series: Binomial Theorem – Statement and Proof – Application to summation.

(Chapter 3: Sections 1,2& 10, 11)

**Unit - II:**

Exponential Theorem – Statement and Proof – Application to summation.

(Chapter 4: Sections 1 to 4)

**Unit - III:**

Logarithmic series: Logarithmic series theorem – Statement and Proof – application to summation.

(Chapter 4: Sections 5 to10)

**Unit - IV:**

Theory of equations: Relation between the roots and coefficients – reciprocal equation.

(Chapter 6: Sections 1 to 11 & 16)

**Unit - V:**

Theory of equations: To increase or decrease the root by a given numbers – Descartes's rule of sign.

(Chapter 6: Sections 17, 18& 24)

**Text Book:**

T.K. ManicavachagomPillay, T. Natarajan and K.S. Ganapathy, Algebra Volume I, S.Viswanatham (printers and publishers) Pvt. Ltd., 1999.

**Reference Books:**

1. S. Arumugam and Isaac, Allied Mathematics paper I, New Gamma Publishing House, 1996.
2. S. Arumugam and Isaac, Allied Mathematics paper IV, New Gamma Publishing House, 1996.

# DIFFERENTIATION AND INTEGRATION

(Course Code: 23UMTEC10)

Semester VI	ECC (Self Study)	Credits -4
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Recall differentiation of various forms of functions (K1)
- CO 2.** Discuss problems using Leibnitz theorem (K2)
- CO 3.** Explain the concepts of curvature, evolutes and envelopes (K2)
- CO 4.** Apply the method of substitution to evaluate integrals (K3)
- CO 5.** Apply the methods to integrate rational and irrational functions (K3)
- CO 6.** Compute integrals using integration by parts (K3)

**Eligibility:** All UG students except from the Department of Mathematics

## UNIT - I:

Derivatives of some standard functions -The chain rule - Differentiation of inverse functions - Differentiation by transformation - Logarithmic differentiation – Parametric differentiation - Differentiation of function with respect to functions - Differentiation of implicit function.

(Part I: Chapter 2: Sections 2.3 - 2.10)

## UNIT - II:

Higher Derivatives -  $n^{\text{th}}$  derivatives and Leibnitz theorem.

(Part I: Chapter 2: Sections 2.11 and 2.12)

## UNIT - III:

Curvature-Evolute- Envelope.

(Part I: Chapter 3: Sections 3.4 - 3.6)

## UNIT - IV:

Some simple integrals- method of substitution - integration of rational functions - Integration of irrational functions - Integration of trigonometric functions

(Part II: Chapter 2: Sections 2.1 - 2.5)

## UNIT - V:

Evaluation of definite integrals –Integration by parts - reduction formulae

(Part II: Chapter 2: Sections 2.6 - 2.8)

## Text Book:

Dr. S. Arumugam and Mr. A. Thangapandi Issac, Calculus, New Gamma Publishing House, 2014.

## Reference Books:

Tom M. Apostol, Calculus, Wiley Student Edition, 2011.

**ALLIED: MATHEMATICS – I**  
**(PHYSICS AND CHEMISTRY)**  
**(Course Code: 23UMTA11)**

<b>Semester - I</b>	<b>EC - 1</b>	<b>Hours - 6</b>	<b>Credits - 5</b>
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**Course outcomes:** By the end of the course the students will be able to

**CO 1.** Define the rank of matrix.(K1)

**CO 2.** Discuss hyperbolic functions and inverse hyperbolic functions.(K2)

**CO 3.** Explain the relation between the coefficients and the roots of algebraic equation.(K2)

**CO 4.** Solve the system of linear equations.(K3)

**CO 5.** Analyze binomial series, exponential series and logarithmic series.(K4)

**CO 6.** Compare two sets of data using correlation. (K5)

**UNIT - I:**

Binomial Series – Exponential Series – The Logarithmic series

(Text book 1: Chapter 1: Sections 1.2-1.4)

**UNIT - II:**

Nature of roots - Relation between the coefficients and the roots of an algebraic equation -Transformation of equations

(Text book 1: Chapter 2: Sections 2.1-2.3)

**UNIT - III:**

Rank of a matrix - Simultaneous linear equations - Cayley - Eigen values and Eigen vectors

(Text book 1: Chapter 3: Sections 3.2 – 3.4)

**UNIT - IV:**

Expansion of  $\sin \theta$  and  $\cos \theta \tan \theta$  in a series of ascending powers of  $\theta$  - Hyperbolic function - Inverse hyperbolic function – Logarithm of complex numbers.

(Text book 1: Chapter 5: Sections 5.3 – 5.5)

**UNIT - V:**

Correlation – Rank Correlation – Regression

(Text book 2: Chapter 1)

**Text Books:**

1. S. Narayanan, R. Hanumantha Rao, T.K. Maicavachagom Pillai and P. Kandaswamy, Ancillary Mathematics Volume I, S. Viswanthan (Printers and Publishers) Pvt. Ltd., 2009.
2. S. Arumugam and Issac, Allied Mathematics paper V, New Gamma Publishing House, 2004

**ALLIED: MATHEMATICS – II**

**(FOR PHYSICS)**

**(Course Code: 23UMTA21)**

<b>Semester – II</b>	<b>EC - 2</b>	<b>Hours - 6</b>	<b>Credits – 5</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO 1.** Discuss the concept of vector differentiation and vector Integration.(K2)
- CO 2.** Discuss Fourier series. (K2)
- CO 3.** Calculate Line, surface and volume integrals using Green, Gauss and Stoke's theorem.(K3)
- CO 4.** Determine partial differential equations and solve the first order partial differentialequations.(K3)
- CO 5.** Illustrate solenoidal and irrotational functions.(K4)
- CO 6.** Solve the differential equations with constant coefficients and homogeneous linearequations.(K5)

**UNIT - I:**

Vector algebra - Differentiation of vectors - Gradient - Divergence and Curl

**(Text book 1: Chapter 5)**

**UNIT - II:**

Line integrals - Surface integrals - Theorems of Green - Gauss and Stokes

**(Text book 1: Chapter 7)**

**UNIT - III:**

Fourier series - Definition - The Cosine and Sine series

**(Text book 2: Chapter 3)**

**UNIT -IV:**

Linear equation with constant coefficients - Methods of finding complementary functions - Methods of finding particular integrals - Homogeneous linear equations

**(Text book 2: Chapter 5: Sections 1- 4)**

**UNIT - V:** Formation of partial differential equations - First order partial differential equations - Methods of solving first order partial differential equations - Some standard forms

**(Text book 2: Chapter 6)**

**Text Books:**

1. S. Arumugam and Issac, Allied Mathematics paper II, New Gamma Publishing House, 2003.
2. S. Arumugam and Issac, Allied Mathematics paper III, New Gamma Publishing House, 2004.

**ALLIED: MATHEMATICS – II**

**(FOR CHEMISTRY)**

**(Course Code: 23UMTA21)**

<b>Semester - II</b>	<b>EC - 2</b>	<b>Hours - 6</b>	<b>Credits - 5</b>
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**Course Outcomes:** By the end of the course the students will be able to

- CO1.** Define group, subgroup, cyclic group and order of an element.(K1)
- CO2.** Recall reduction formulae for trigonometric functions.(K1)
- CO3.** Discuss the relation between order of an element and order of the group using Lagrange's theorem.(K2)
- CO4.** Solve ordinary differential equation and partial differential equation (K3)
- CO5.** Classify the types of partial differential equations.(K4)
- CO6.** Evaluate double and triple integrals. (K5)

**UNIT - I:**

Groups - Subgroups - Cyclic groups - Order of an element - Cosets and Lagrange's theorem.

**(Text book 1: Sections 2.5, 2.6, 2.10)**

**UNIT - II:**

Linear equations with constant coefficients - Methods of finding complementary functions - Methods of finding particular integrals - Homogeneous linear equations.

**(Text book 2: Chapter 5 (Sections 1- 4))**

**UNIT - III:**

Formation of partial differential equations - First order partial differential equations - Some standard forms.

**(Text book 2: Chapter 6)**

**UNIT - IV:**

Definite integrals - Integration by parts - Reduction formulae for  $\sin^n x dx$ ,  $\cos^n x dx$ , and  $\tan^n x dx$  only

**(Text book 3: Sections 1.2 and 1.3)**

**UNIT - V:**

Double integrals - Triple integrals - Jacobians - Change of variables in double and triple integrals.

**(Text book 3: Chapter 6)**

**Text Books:**

1. S. Arumugam and Issac, Allied Mathematics paper IV, New Gamma Publishing House, 1996
2. S. Arumugam and Issac, Allied Mathematics paper III, New Gamma Publishing House, 2004
3. S. Arumugam and Issac, Allied Mathematics paper II, New Gamma Publishing House, 2003