

Phone: Off: +91-40-23158665  
Fax: +91-40-23158665  
Web : [www.jntuh.ac.in](http://www.jntuh.ac.in)  
E Mail: [pa2registrar@jntuh.ac.in](mailto:pa2registrar@jntuh.ac.in)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**  
(Established by Govt. Act No.30 of 2008)  
Kukatpally, Hyderabad – 500 085, Telangana (India)

**DR. N.YADAJAH**

B.E (OUCE), M. Tech (HT KGP), Ph.D.(JNTU)  
SMIEEE, FIE, FIETE, MSSI, MISTE

**Professor of EEE &  
REGISTRAR**

Lr.No.D1/960/2018

Date: 09.02.2018

To,  
The Principal,  
Malla Reddy Engineering College,  
Maisammaguda,  
Dhulapally (Post Via Kompally),  
Secunderabad.

Sir,

Sub: JNT University Hyderabad-Academic & Planning – Nominations of members for Academic Council, Governing Body and Board of Studies of various Departments of Malla Reddy Engineering College, Maisammaguda, Dhulapally (Post Via Kompally), Secunderabad.

Ref: 1. Your Lr No. MREC/Autonomous/BOS/2017-18/1, dated 17.01.2018.  
2. Note Orders of the Vice-Chancellor dated 01.02.2018.

\*\*\*

With reference to your letter 1<sup>st</sup> cited, I am by direction to inform you that the following faculty members of the University are nominated for the following bodies for a period of three years as per the UGC guidelines as desired by you:

**I Academic Council (Three members)**

S.No	Name of the University Nominee
1	Dr. G.K. Vishwanadh, Prof. of CE & OSD to VC, JNTUH
2	Dr.B. Balu Naik, Prof. of ME & Director, UGC-HRDC, JNTUH
3	Dr.N.V. Ramana, Prof. of EEE & Principal, JNTUH CEJ

**II Governing Body (One member)**

S.No	Name of the University Nominee
1	Dr.B.N. Bhandari, Prof. of ECE & Director, Academic & Planning, JNTUH

*[Signature]*  
**PRINCIPAL**  
Malla Reddy Engineering College  
(Autonomous)  
Maisammaguda, Dhulapally,  
(Post via Kompally) Sec:bad-500 085



**III. Board of Studies (One nominee for each department)**

S.No	Name of the Department	Courses	Name of the University Nominee
1	Civil	B.Tech/M.Tech	Dr. S. Srinivasulu, Prof of Civil JNTUH CEH
2	EEE	B.Tech/M.Tech	Dr.M. Suryakalavathi, Prof. of EEE, JNTUH CEH
3	Mech/Mining	B.Tech/M.Tech	Dr.K. Vijay Kumar Reddy Prof. of ME, JNTUH CEH
4	ECE	B.Tech/M.Tech	Dr.D.Srinivasa Rao, Prof. of ECE, JNTUH CEH
5	CSE/IT	B.Tech/M.Tech	Dr..V. Kamakshi Prasad, Prof. of CSE, & DE, JNTUH
6	MBA	MBA	Dr.D.Raghunatha Reddy, Prof of SMS, JNTUH
7	Physics	B.Tech	Dr.K. Vijaya Kumar, Assoc. Prof. in Physics, JNTUH CES
8	Chemistry	B.Tech	Dr.A.Jaya Shree, Prof. of Chemistry, CCST, IST, JNTUH
9	Mathematics	B.Tech	Dr.V.Srinivasa Kumar, Asst. Prof in Mathematics, JNTUH CEH
10	English	B.Tech	Dr.V.Parvathi, Prof & Head H&SS, JNTUH CEH

Yours sincerely,

*[Signature]*  
✓ REGISTRAR

*[Signature]*

Copy to the individuals concerned  
Copy to PA to VC/Rector/Registrar for information

*[Signature]*  
**PRINCIPAL**  
**Malla Reddy Engineering College**  
**(Autonomous)**  
**Maisammaguda, Dhulapally,**  
**(Post Via Kompally), Sec'bad-500 100**



**MALLA REDDY ENGINEERING COLLEGE**  
(AUTONOMOUS)  
Department of Mathematics

The Board of Studies meeting for Mathematics is held through online mode on 11.07.2020

The following members have attended to review on matters such as Schema, Syllabus of MR20 regulations, Mathematics related subjects and other points as per agenda.

S. No	Name of the Member	Designation & Official Address	Category	Signature
1	Mrs. S Saroja	Assoc. Prof. & HOD	Chairman - BOS	S. Saroja
2	Dr. V Srinivasa Kumar	Assoc. Professor, JNTUH, Hyderabad.	University Nominee	— ONLINE —
3	Dr. B Ravindra Reddy	Assoc. Professor, JNTUH, Hyderabad.	Subject Expert	— ONLINE —
4	Dr. V V Haragopal	Professor, BITS, Hyderabad	Subject Expert	— ONLINE —
5	Dr. C Subrahmanya Sastry	Assoc. Professor, IIT, Hyderabad.	Subject Expert	— ONLINE —
6	Dr. R Kedarnath	Delivery Head, Release Point, Hyderabad	Industry Nominee	— ONLINE —
7	Dr. P Sarada Devi	Asst. Professor, Dept. of Mathematics	Faculty Member	P.S.
8	Dr. Y Suresh Kumar	Assoc. Professor, Dept. of Mathematics	Faculty Member	P. K. Suresh Kumar
9	Mr. P Kalyan Kumar	Assoc. Professor, Dept. of Mathematics	Faculty Member	Y. Suresh Kumar
10	Mr. G Gangadhar	Asst. Professor, Dept. of Mathematics	Faculty Member	G. Gangadhar
11	Ms. G Deepika	Jr. Engineer, Hyderabad Road Development Corporation	Alumni	— ONLINE —

Principal  
Malla Reddy Engineering College  
(Autonomous)  
Maisammaguda, Dhulapally,  
(Post Via Kompally), Sec'bad-500 104







# Malla Reddy Engineering College

## (AUTONOMOUS)

(An UGC Autonomous Institution approved by AICTE and affiliated to JNTU Hyderabad, Accredited by NAAC with 'A' Grade (II - cycle)  
NBA Accredited Programmes - UG (CE, EEE, ME, ECE & CSE) PG (CE - Structural Engg., EEE-Electrical Power Systems, ME - Thermal Engg.).

Date: 06.07.2020

### ORDER

Malla Reddy Engineering College (Autonomous) is a self-financed UGC-Autonomous Institution, Approved by AICTE and affiliated to Jawaharlal Nehru Technological University, Hyderabad, Recognized under 2(f) & 12 (B) of UGC Act 1956, Accredited by NAAC with 'A' Grade (II Cycle) and NBA (UG-CE, EEE, ME, ECE, CSE & PG-SE, TE and EPS). The department academic activities are governed through a Board of Studies which is responsible for its overall framing of schema and syllabus for various courses in the keeping in view the objectives of the college, interest of the stakeholders and national requirement for consideration and forwards for approval of the Academic Council.

The UG - B.Tech.(CSE) Board of Studies for the Academic Year 2020-21 have been reconstituted as some of the previous members' relieved from the institute and as per the UGC guidelines with the following members.

The following is the list of Board of Studies members Constituted for the Academic Year 2020-21.

S. No.	Name of the Member	Qualification	Phone no. & e-mail id	Subject Specialization	Position	Category
<b>Chairman (Head of the Department concerned)</b>						
1	Mrs. S Saroja	Assoc. Prof. & HOD	8142345198, sandirisaroja@gmail.com	Mathematics	Chairman	Chairman
<b>One expert to be nominated by the Vice-Chancellor of the Affiliating University</b>						
2	Dr. V Srinivasa Kumar	Assoc. Professor, JNTUH, Hyderabad.	9652520088 srinu_vajha@jntuh.ac.in	Mathematics	Member	University Nominee
<b>Two subject experts from outside the Parent University to be nominated by the Academic Council</b>						
3	Dr. B Ravindra Reddy	Assoc. Professor, JNTUH, Hyderabad.	9949567359, rbollareddy@gmail.com	Mathematics	Member	Subject Expert
4	Dr. V V Haragopal	Professor, BITS, Hyderabad	9849083995, haragopalvajha@gmail.com	Mathematics	Member	Subject Expert
5	Dr. C Subrahmanya Sastry	Assoc. Professor, IIT, Hyderabad.	9963128002, csastry@iith.ac.in	Mathematics	Member	Subject Expert
<b>One representative from industry/corporate sector/allied area relating to placement.</b>						
6	Dr. R Kedarnath	Delivery Head, Release Point, Hyderabad	9963029063, kedamathr@gmail.com	Mathematics	Member	Industry Expert
<b>The faculty of specialization.</b>						
7	Dr. P Sarada Devi	Asst. Professor, Dept. of Mathematics	7032693705, sarada.chakireddy@gmail.com	Mathematics	Member	Teaching staff
8	Dr. Y Suresh Kumar	Assoc. Professor, Dept. of Mathematics	9177770282, suresh.msfc@gmail.com	Mathematics	Member	Teaching staff
9	Mr. P Kalyan Kumar	Assoc. Professor, Dept. of Mathematics	9030924067, kalyankumar.palaparathi@gmail.com	Mathematics	Member	Teaching staff
10	Mr. G Gangadhar	Asst. Professor, Dept. of Mathematics	9948941817, gangadharg001@gmail.com	Mathematics	Member	Teaching staff
<b>One postgraduate meritorious alumnus to be nominated by the principal.</b>						
11	Ms. G Deepika	Jr. Engineer Hyderabad Road Development Corporation	7032996233, deepikagujja01@gmail.com	B.Tech Civil Engineer	Member	Alumni (MR13Batch)

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Malla Reddy Engineering College  
(Autonomous)

Maisammaguda, Dhulapally,

**PRINCIPAL**



# Malla Reddy Engineering College

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### Department of Mathematics

Date: 06/07/2020

To  
The Principal  
MREC(A)  
Secunderabad – 500 100

#### Sub: Request to approve the constitution of BOS – Dept. of Mathematics for the Academic Year 2020-21

The following are the proposed Board-of-Studies members for the Department of Mathematics for the AY 2020-21. Requesting you to approve the same.

S. No.	Name of the Member	Designation & Official Address	Subject Specialization	Contact No.	e-mail	Category
1	Mrs. S Saroja	Assoc. Prof & HOD	Mathematics	81423 45198	sandirisaroja@gmail.com	Chairman- BOS
2	Dr. V. Srinivas Kumar	Assoc. Professor, JNTUH, Hyderabad	Mathematics	96525 20088	<a href="mailto:srinu_vajha@jntuh.ac.in">srinu_vajha@jntuh.ac.in</a>	University Nominee
3	Dr. B Ravindra Reddy	Assoc. Professor, JNTUH, Hyderabad	Mathematics	9949567359	rbollareddy@gmail.com	Subject Expert
4	Dr. V V Haragopal	Professor, BITS Pilani, Hyderabad Campus	Mathematics	98490 83995	haragopalvajjha@gmail.com	Subject Expert
5	Dr. C Subrahmanya Sastry	Assoc. Professor, IIT, Hyderabad	Mathematics	99631 28002	csastry@iith.ac.in	Subject Expert
6	Dr. R Kedarnath	Software Engineer, SNPIQ, Hyderabad	Mathematics	99630 29063	kedarnathr@gmail.com	Industry Nominee
7	Dr. P sarada Devi	Asst. Professor	Mathematics	7032693705	Sarada.chakireddy@gmail.com	Member
8	Dr. Y Suresh Kumar	Assoc. Professor	Mathematics	91777 70282	suresh.mscf@gmail.com	Member
9	Mr. P Kalyan Kumar	Assoc. Professor	Mathematics	90309 24067	kalyankumar.palaparathi@gmail.com	Member
10	Mr. G Gangadhar	Asst. Professor	Mathematics	99489 41817	gangadharg001@gmail.com	Member
11	Ms. G Deepika	Jr. Engineer, Hyderabad Road Development Corporation	Structures Engineering	7032996233	Deepikagujja01@gmail.com	Alumni

*Ravind*  
PRINCIPAL  
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Maisammaguda, Dhulapally,  
(Post Via Kompally), Sec'bad-500 100

*S. Saroja*  
S Saroja  
Chairman – BOS





# Malla Reddy Engineering College

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Lr.No: MREC (A)/BOS-Mathematics: 2020-21/Invitation/04

06-07-2020

To  
Dr. R Kedarnath  
Delivery Head,  
Release Point, Hyderabad.

Sir,

Sub: Meeting of the Board of Studies for Mathematics for the academic year 2020-21.

It is my pleasure to invite you to the meeting of the Board of Studies for Mathematics for the academic year 2020-21. The meeting will be conducted on 11<sup>th</sup> July, 2020 (Saturday) at 10.30 AM through online mode. We request you to make it convenient to attend the meeting.

## AGENDA:

1. Review of the schema of instructions of B.Tech for the academic year 2020-21.
2. Proposal/deciding the panel of examiners and valuers.
3. Any other issue with the permission of the chair.

  
Director

Copy to:

1. Registrar, JNTUH
2. P.A. to the Vice-Chancellor, JNTUH
3. Director (AAC), JNTUH.

  
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Lr.No: MREC (A)/BOS-Mathematics: 2020-21/Invitation/05

06-07-2020

To  
Dr. B Ravindra Reddy  
Assoc. Professor,  
JNTUH, Hyderabad.

Sir,

Sub: Meeting of the Board of Studies for Mathematics for the academic year 2020-21.

It is my pleasure to invite you to the meeting of the Board of Studies for Mathematics for the academic year 2020-21. The meeting will be conducted on 11<sup>th</sup> July, 2020(Saturday) at 10.30AM through online mode . We request you to make it convenient to attend the meeting.

### AGENDA:

1. Review of the schema of instructions of B.Tech for the academic year 2020-21.
2. Proposal/deciding the panel of examiners and valuers.
3. Any other issue with the permission of the chair.

  
Director

Copy to:

1. Registrar, JNTUH
2. P.A. to the Vice –Chancellor, JNTUH
3. Director (AAC), JNTUH.





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NBA Accredited Programmes - UG (CE, EEE, ME, ECE & CSE) PG (CE - Structural Engg., EEE-Electrical Power Systems, ME - Thermal Engg.).

Lr.No: MREC (A)/BOS-Mathematics: 2020-21/Invitation/02

06-07-2020

To  
Dr. C Subrahmanya Sastry  
Assoc. Professor,  
IIT, Hyderabad.

Sir,

Sub: Meeting of the Board of Studies for Mathematics for the academic year 2020-21.

It is my pleasure to invite you to the meeting of the Board of Studies for Mathematics for the academic year 2020-21. The meeting will be conducted on 11<sup>th</sup> July, 2020(Saturday) at 10.30AM through online mode. We request you to make it convenient to attend the meeting.


#### AGENDA:

1. Review of the schema of instructions of B.Tech for the academic year 2020-21.
2. Proposal/deciding the panel of examiners and valuers.
3. Any other issue with the permission of the chair.

  
Director

#### Copy to:

1. Registrar, JNTUH
2. P.A. to the Vice-Chancellor, JNTUH
3. Director (AAC), JNTUH.

  
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(Autonomous)  
Maisammaguda, Dhulapally,  
(Post Via Kompally), Medchal-500 100







# Malla Reddy Engineering College

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Lr.No: MREC (A)/BOS-Mathematics: 2020-21/Invitation/01

06-07-2020

To  
Dr. V Srinivasa Kumar  
Assoc. Professor,  
JNTUH, Hyderabad.

Sir,

Sub: Meeting of the Board of Studies for Mathematics for the academic year 2020-21.

It is my pleasure to invite you to the meeting of the Board of Studies for Mathematics for the academic year 2020-21. The meeting will be conducted on 11<sup>th</sup> July, 2020(Saturday) at 10.30AM through online mode . We request you to make it convenient to attend the meeting.

### AGENDA:

1. Review of the schema of instructions of B.Tech for the academic year 2020-21.
2. Proposal/deciding the panel of examiners and valuers.
3. Any other issue with the permission of the chair.

  
Director

### Copy to:

1. Registrar, JNTUH
2. P.A. to the Vice -Chancellor, JNTUH
3. Director (AAC), JNTUH.

  
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11/6/2020

Malla reddy engineering college Mail - e-approval for approving MR20 syllabus-Reg.



Mrec Mathematics Department <mathshod@mrec.ac.in>

## e-approval for approving MR20 syllabus-Reg.

kedarnath rudravaram <kedarnathr@gmail.com>

To: Mrec Mathematics Department <mathshod@mrec.ac.in>

Tue, Oct 20, 2020 at 9:56 PM

Hello Team - As per the meeting on 11th July 2020, the syllabus attached are approved.

Thanks - Kedar  
[Quoted text hidden]

  
PRINCIPAL  
Malla Reddy Engineering College  
(Autonomous)  
Matsammaguda, Dhulapally,  
(Post-Via Kompally), Sec'bad-500 100.





Mrec Mathematics Department &lt;mathshod@mrec.ac.in&gt;

**e-approval for approving MR20 syllabus-Reg.**

C S Sastry &lt;csastry@math.iith.ac.in&gt;

Tue, Oct 20, 2020 at 10:11 PM

To: Mrec Mathematics Department &lt;mathshod@mrec.ac.in&gt;

Cc: Vajjha Venkata HaraGopal &lt;haragopalvajjha@gmail.com&gt;, kedarnath rudravaram &lt;kedarnathr@gmail.com&gt;, srinivas kumar &lt;vajhasrinu@gmail.com&gt;

Dear Dr. Saroja Garu,

This email may be considered as my e-approval for MR20 syllabus.

With thanks and regards,

Sastry

[Quoted text hidden]

Disclaimer:- The information contained in this electronic message and any attachments to this message are intended for the exclusive use of the addressee(s) and may contain proprietary, confidential or privileged information. If you are not the intended recipient, you should not disseminate, distribute or copy this email.

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Mrec Mathematics Department &lt;mathshod@mrec.ac.in&gt;

**e-approval for approving MR20 syllabus-Reg.**

V V HaraGopal &lt;haragopalvajjha@gmail.com&gt;

Wed, Oct 21, 2020 at 6:37 AM

To: Mrec Mathematics Department &lt;mathshod@mrec.ac.in&gt;

Dear Madam

I e-approve the syllabus MR20.

Best Wishes  
V V HaraGopalDr V V HaraGopal,  
Professor of Statistics,  
Department of Mathematics,  
Birla Institute of Technology & Science, Pilani

Hyderabad Campus, Jawahar Nagar, Shameerpet Mandal, Hyderabad 500 078, Telangana, India.

Formerly Professor, Department of Statistics  
Osmania University, Hyd.

Mobile +919849083995

Email: haragopal\_vajjha@hyderabad.bits-pilani.ac.in

Web: <http://www.bits-pilani.ac.in/hyderabad/HaraGopal/Profile>

Sent from my iPhone.

On 20-Oct-2020, at 9:45 PM, Mrec Mathematics Department &lt;mathshod@mrec.ac.in&gt; wrote:

[Quoted text hidden]

&lt;APPLIED STATISTICS AND OPTIMIZATION TECHNIQUES.docx&gt;

&lt;CE,ME,Mining I sem.docx&gt;

&lt;CSE IT.docx&gt;

&lt;ECE &amp; EEE III SEM syllabus format.docx&gt;

&lt;CE,ME ,MINING II sem.docx&gt;

&lt;ECE, EEE I sem.docx&gt;

&lt;P&amp;S NEW.docx&gt;

&lt;MATHEMATICS-EEE &amp; ECE-MR20-II SEM.docx&gt;

&lt;QA&amp;R-Sem-1.docx&gt;

&lt;QA&amp;R-Sem-2.docx&gt;

*Handwritten signature*  
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(Post Via Kompally), Sec'bad-500 100



11/6/2020

Malla reddy engineering college Mail - e-approval for approving MR20 syllabus-Reg.



Mrec Mathematics Department <mathshod@mrec.ac.in>

## e-approval for approving MR20 syllabus-Reg.

Ravindra Reddy B <rbollareddy@gmail.com>

To: Mrec Mathematics Department <mathshod@mrec.ac.in>

Wed, Oct 21, 2020 at 10:52 AM

Dear Sir / Madam,

MR20 syllabus is approved.

with regards,

Dr. B. Ravindra Reddy  
Associate Professor of Mathematics &  
Addl. Controller of Examinations,  
JNTUH

[Quoted text hidden]



  
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11/6/2020

Malla reddy engineering college Mail - e-approval for approving MR20 syllabus-Reg.



Mrec Mathematics Department <mathshod@mrec.ac.in>

## e-approval for approving MR20 syllabus-Reg.

Wed, Oct 21, 2020 at 10:57 AM

srinivas kumar <vajhasrinu@gmail.com>

To: Mrec Mathematics Department <mathshod@mrec.ac.in>

From

Dr V. Srinivasa kumar  
Department of Mathematics  
JNTUH college of Engineering  
JNTU, Kukatpally  
Hyderabad

Dear sir/ madam,

The syllabus has been approved and you can go head.

Thanking you

Dr V. Srinivasa kumar

On 20-Oct-2020, at 9:45 PM, Mrec Mathematics Department <mathshod@mrec.ac.in> wrote:

[Quoted text hidden]

[Quoted text hidden]

*Rund*  
PRINCIPAL  
Malla Reddy Engineering College  
(Autonomous)  
Maisammaguda, Dhulapally,  
(Post Via Kompally), Sec'bad-500 100





# MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

Department of Mathematics

11<sup>th</sup> July 2020.

## Minutes of Meeting Mathematics BOS

The 13<sup>th</sup> Board of Studies meeting for Mathematics is held through Google meet online on 11<sup>th</sup> July 2020.

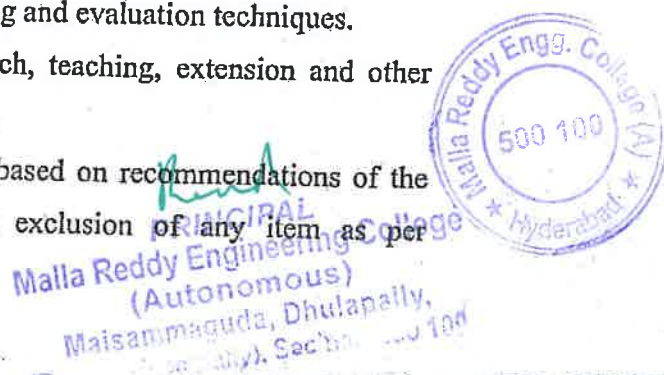
Formally Head of the Department Mrs. S Saroja welcomed the members of the BOS to the meeting.

The following members have attended to review on matters such as Credits Syllabus of MR20 regulations Mathematics related subjects, Quantitative aptitude for III B.Tech of MR18 regulations and other points as per agenda.

Mrs. S Saroja	-	Chairman BOS
Prof. V V Haragopal	-	Member – Subject Expert (External Member)
Dr. C S Sastry	-	Member – Subject Expert (External Member)
Dr. V Srinivas Kumar	-	Member – Subject Expert (University Nominee)
Dr. B Ravindra Reddy	-	Member – Subject Expert (External Member)
Dr. R Kedarnath	-	Member – Subject Expert (Industry Nominee)
Dr. P Sarada Devi	-	Member – Subject Expert (Internal Member)
Dr. Y Suresh Kumar	-	Member – Subject Expert (Internal Member)
Mr. P Kalyan Kumar	-	Member – Subject Expert (Internal Member)
Mr. G Gangadhar	-	Member – Subject Expert (Internal Member)
Mr. V Naga Raju	-	Member – Subject Expert (Internal Member)

The following is the agenda of the meeting:

1. Action Taken Report (ATR) on previous BoS Meeting in A.Y 2019-20
2. Discussion and review of Mathematics subjects of B. Tech. MR20 regulations course schema and syllabus. Quantitative aptitude for III B.Tech of MR18 regulations and syllabus.
3. Suggestion and review of panel for Paper setters, and examiners for examinations.
4. Suggest methodologies for innovative teaching and evaluation techniques.
5. Suggestion of any activity related to research, teaching, extension and other academic activities in the department/college.
6. Delegation of power to the Chairman-BOS based on recommendations of the internal committee, for the inclusion and exclusion of any item as per



7. Approval of any other item with the permission of the Chairman.

The following resolutions are made after careful discussion and observations for the implementation in the next Regulations

1. It has decided to have separate courses for CSE, CSE related & IT and EEE, ECE and CE, ME, MINING branches in the I B.Tech I-Semester.
2. After an elaborated discussion regarding the paper Engineering Mathematics-I, it is decided to include Numerical methods also in the I B.Tech I-Sem course for all CSE, CSE related & IT Branches.
3. Engineering Mathematics - I paper is re named as Linear Algebra and Numerical Methods considering the content of the syllabus in the I B.Tech I-Sem course for all CSE, CSE related & IT Branches.
4. The syllabus is arranged as Matrix algebra, Eigen values and Eigen Vectors, Algebraic & Transcendental Equations, Interpolation and Numerical solution of Ordinary Differential Equations as Modules I, II, III, IV and V respectively for the I B.Tech I-Sem course for all CSE, CSE related & IT Branches.
5. Considering the mathematical applications for EEE & ECE Branches the title Engineering Mathematics-I as Linear Algebra and Applied Calculus in the I B.Tech I-Sem course
6. The topic of First order and first degree differential equations variables separable, homogeneous and exact and non-exact differential equations is removed from the proposed syllabus for the I B.Tech I-Sem course for EEE & ECE Branches.
7. The syllabus is arranged as Matrix algebra, Eigen values and Eigen Vectors, Ordinary Differential Equations, Series Solutions to Differential Equations and Differential Calculus as Modules I, II, III, IV and V respectively for the I B.Tech I-Sem course for EEE & ECE Branches.
8. With the discussions of the applications of mathematics in Civil, Mech. & Mining Engineering Branches the title Engineering Mathematics-I as Linear Algebra and Differential Equations in the I B.Tech I-Sem course.
9. With the importance of partial differential equations and its applications for Civil, Mech. & Mining Engineering Branches the topic partial differential equations are added as Module -V in the I B.Tech I-Sem course.
10. The syllabus is arranged as Matrix algebra, Eigen values and Eigen Vectors, Differential Calculus, Ordinary Differential Equations and Partial Differential Equations, as Modules I, II, III, IV and V respectively for the I B.Tech I-Sem course for CE, ME and MINING Branches.

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26. The syllabus is arranged as Analysis of Variance & Analysis of Co-variance, Design of Experiments, Transportation & Assignment problems, Game Theory and Queuing Theory as Modules I, II, III, IV and V respectively in Applied Statistics and Optimization Techniques.
27. Considering the importance of Numerical Techniques for EEE & ECE it is decided to introduce Numerical Methods in II B.Tech I Sem.
28. It is also decided to keep the topics complex variables for EEE & ECE Branches.
29. It is decided to merge the Modules Power series expansions of complex functions and Module Counter Integration as Module-III for II B.Tech I Sem for EEE & ECE Branches.
30. It is decided to remove the Numerical Partial differential equations from as the syllabus is heavy in the proposed syllabus of II B.Tech I Sem for EEE & ECE Branches.
31. The Course is titled as Complex variables and Numerical Methods for II B.Tech I Sem for EEE & ECE Branches.
32. The syllabus is arranged as Complex Functions, Complex Integration, Power series expansions of complex functions & Contour Integration, Algebraic & Transcendental equations and Interpolation and Numerical solution of Ordinary Differential Equations & Numerical Integration as Modules I, II, III, IV and V respectively in Complex variables and Numerical Methods.
33. Considering the importance of Quantitative Aptitude for all the Engineering Graduates, it is approved to keep Quantitative Aptitude in III B.Tech I Sem for all Branches of Engineering for MR18 regulations batch.
34. It is decided to keep Quantitative Aptitude -I in III B.Tech I Sem for MR18 regulations.
35. It is decided to keep Quantitative Aptitude -II in III B.Tech II Sem for MR18 regulations.

S. Saroj  
Chairman - BOS

  
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# MALLA REDDY ENGINEERING COLLEGE

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Department of Mathematics

15-07-2020

## Board of Studies meeting held on 11.07.2020 at 10:30 AM

The Board of Studies meeting for the Department of Mathematics is convened on 11.07.2020 at 10:30 AM through online.

### Action Taken Report (ATR) on BoS Meeting in AY 2020-21

**Resolution 1:** It has decided to have separate courses for CSE, CSE related & IT and EEE, ECE and CE, ME, MINING branches in the I B.Tech I-Semester.

**Action Taken:** Action taken accordingly as recommended by the BOS

**Resolution 2:** After an elaborated discussion regarding the paper Engineering Mathematics-I, it is decided to include Numerical methods also in the I B.Tech I-Sem course for all CSE, CSE related & IT Branches.

**Action Taken:** The concept of Numerical Methods was introduced in Engineering Mathematics-I for all CSE, CSE related & IT Branches.

**Resolution 3:** Engineering Mathematics - I paper is re named as Linear Algebra and Numerical Methods considering the content of the syllabus in the I B.Tech I-Sem course for all CSE, CSE related & IT Branches.

**Action Taken:** By observing the content of the syllabus EM-I, it is renamed as Linear Algebra and Numerical Methods for all CSE, CSE related & IT Branches.

**Resolution 4:** The syllabus is arranged as Matrix algebra, Eigen values and Eigen Vectors, Algebraic & Transcendental Equations, Interpolation and Numerical solution of Ordinary Differential Equations as Modules I, II, III, IV and V respectively for the I B.Tech I-Sem course for all CSE, CSE related & IT Branches.

**Action Taken:** The syllabus of CSE & IT branches are modified according to the suggestions given by the BOS members.

**Resolution 5:** Considering the mathematical applications for EEE & ECE Branches the title Engineering Mathematics-I as Linear Algebra and Applied Calculus in the I B.Tech I-Sem course.

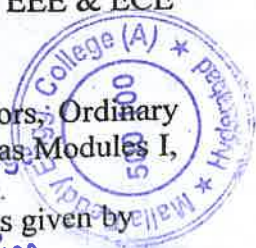
**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 6:** The topic of First order and first degree differential equations variables separable, homogeneous and exact and non-exact differential equations is removed from the proposed syllabus for the I B.Tech I-Sem course for EEE & ECE Branches.

**Action Taken:** Solution of First order and first degree differential equations variables separable, homogeneous and exact and non-exact differential equations for I B.Tech I-Sem course for EEE & ECE Branches was removed as they studied earlier.

**Resolution 7:** The syllabus is arranged as Matrix algebra, Eigen values and Eigen Vectors, Ordinary Differential Equations, Series Solutions to Differential Equations and Differential Calculus as Modules I, II, III, IV and V respectively for the I B.Tech I-Sem course for EEE & ECE Branches.

**Action Taken:** The syllabus of EEE, ECE branches are modified according to the suggestions given by the BOS members.



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**Resolution 8:** With the discussions of the applications of mathematics in Civil, Mech. & Mining Engineering Branches the title Engineering Mathematics-I as Linear Algebra and Differential Equations in the I B.Tech I-Sem course.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 9:** With the importance of partial differential equations and its applications for Civil, Mech. & Mining Engineering Branches the topic partial differential equations are added as Module -V in the I B.Tech I-Sem course.

**Action Taken:** The revised scheme of instructions is implemented as MR20 regulations B.Tech course schema of instructions and implemented from the academics year 2020-21.

**Resolution 10:** The syllabus is arranged as Matrix algebra, Eigen values and Eigen Vectors, Differential Calculus, Ordinary Differential Equations and Partial Differential Equations, as Modules I, II, III, IV and V respectively for the I B.Tech I-Sem course for CE, ME and MINING Branches.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 11:** It is proposed Probability & Statistics Course for CSE, CSE related & IT for the I B.Tech II-Sem and for CE, ME, MINING for the II B.Tech II-Sem and it is accepted by all the members of the BOS.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 12:** It has decided to include Uniform distribution, Central limit theorem as last topic in Module -II for Probability & Statistics.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 13:** It has decided to remove Queuing Theory and introduce the topics Correlation and Regression as the topics in Module - V for Probability & Statistics.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 14:** The syllabus is arranged as Introduction to Probability, Random variables, Sampling Distributions, Small sample tests, Correlation-Regression as Modules I, II, III, IV and V respectively for Probability & Statistics course.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 15:** After the discussion of the importance of calculus for EEE & ECE students it has been decided to introduce some Advanced topics of Calculus in I B.Tech II Sem with title Advanced Calculus.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 16:** It is decided to replace Beta and Gamma functions in Module-II in place of partial differential equations of the proposed syllabus.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 17:** It is decided to split Vector Calculus in to two Modules as Vector Differentiation as Module-IV and Vector Integration as Module-V.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 18:** The syllabus is arranged as Partial Differential Equations, Beta and Gamma functions, Multiple Integrals, Vector Differentiation and Vector Integration as Modules I, II, III, IV and V respectively in Advanced Calculus course.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 19:** With the discussions in the meeting it has been decided to include Numerical Techniques in I B.Tech II Sem for CE, ME and MINING Branches.

**Action Taken:** Numerical Techniques is introduced in I B.Tech II Sem for CE, ME and MINING Branches according to the suggestion given by the BOS members.



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**Resolution 20:** Considering the importance of Vector Calculus, for CE, ME and MINING Engg., Vector Calculus is introduced.

**Action Taken:** Vector Calculus is introduced according to the suggestions given by the BOS members.

**Resolution 21:** The course is titled as Vector Calculus and Numerical Techniques in I B.Tech II Sem for CE, ME and MINING Branches.

**Action Taken:** According to the BOS members suggestion course is titled as Vector Calculus and Numerical Techniques in I B.Tech II Sem for CE, ME and MINING Branches.

**Resolution 22:** The syllabus is arranged as Vector Differentiation, Vector Integration, Algebraic and Transcendental Equations, Numerical solution of Ordinary Differential Equations, Numerical solution of Partial Differential Equations as Modules I, II, III, IV and V respectively in Vector Calculus and Numerical Techniques course.

**Action Taken:** The revised scheme of instructions is implemented as MR20 regulations B.Tech course schema of instructions and implemented from the academics year 2020-21.

**Resolution 23:** Considering the importance of Data Analysis for the latest technology in computers it is decided to introduce some statistical analysis for CSE, CSE related and IT Branches.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 24:** Introduced the Optimization techniques Transportation, Assignment problems, Game Theory and Queuing Theory in II B.Tech II Sem for CSE, CSE related and IT Branches.

**Action Taken:**

**Resolution 25:** The course is titled as Applied Statistics and Optimization Techniques for CSE, CSE related and IT Branches in II B.Tech II Sem.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 26:** The syllabus is arranged as Analysis of Variance & Analysis of Co-variance, Design of Experiments, Transportation & Assignment problems, Game Theory and Queuing Theory as Modules I, II, III, IV and V respectively in Applied Statistics and Optimization Techniques.

**Action Taken:** The revised scheme of instructions is implemented as MR20 regulations B.Tech course schema of instructions and implemented from the academics year 2020-21.

**Resolution 27:** Considering the importance of Numerical Techniques for EEE & ECE it is decided to introduce Numerical Methods in II B.Tech I Sem.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 28:** It is also decided to keep the topics complex variables for EEE & ECE Branches.

**Action Taken:** Action taken accordingly as recommended by the BOS.

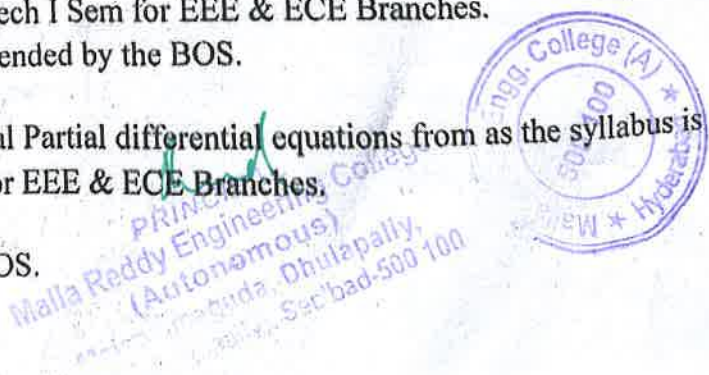
**Resolution 29:** It is decided to merge the Modules Power series expansions of complex functions and Module Counter Integration as Module-III for II B.Tech I Sem for EEE & ECE Branches.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 30:** It is decided to remove the Numerical Partial differential equations from as the syllabus is heavy in the proposed syllabus of II B.Tech I Sem for EEE & ECE Branches.

**Action Taken:**

**Action taken** accordingly as recommended by the BOS.





**Resolution 31:** The Course is titled as Complex variables and Numerical Methods for II B.Tech I Sem for EEE & ECE Branches.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 32:** The syllabus is arranged as Complex Functions, Complex Integration, Power series expansions of complex functions & Contour Integration, Algebraic & Transcendental equations and Interpolation and Numerical solution of Ordinary Differential Equations & Numerical Integration as Modules I, II, III, IV and V respectively in Complex variables and Numerical Methods.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 33:** Considering the importance of Quantitative Aptitude for all the Engineering Graduates, it is approved to keep Quantitative Aptitude in III B.Tech I Sem for all Branches of Engineering for MR18 regulations batch.

**Action Taken:** Action taken accordingly as recommended by the BOS.

**Resolution 34:** It is decided to keep Quantitative Aptitude –I in III B.Tech I Sem for MR18 regulations.

**Action Taken:** Approved the Paper titled ' Quantitative Aptitude and Reasoning –I ' is prescribed in the III Year I semester for all branches. The proposed syllabus as such is approved by the members without any modifications.

**Resolution 35:** It is decided to keep Quantitative Aptitude –II in III B.Tech II Sem for MR18 regulations.

**Action Taken:** Approved the Paper titled ' Quantitative Aptitude and Reasoning –II ' is prescribed in the III Year II semester for all branches. The proposed syllabus as such is approved by the members without any modifications

**Resolution 36:** It has decided to introduce new paper "Number theory" for CSE(Cyber security) in IV Semester of MR20 regulations.

**Action Taken:** The revised syllabus is implemented as MR20 regulation B.Tech course syllabus is implementing from the academic year 2020-21 onwards.

**Resolution 37:** After an elaborated discussion, new paper "Statistics for Data Science" was introduced for CSE (Data Science) in IV Semester of MR20 regulations.

**Action Taken:** The revised syllabus is implemented as MR20 regulation B.Tech course syllabus is implementing from the academic year 2020-21 onwards.

**Resolution 38:** With the discussions in the meeting it has been decided to introduce open Electives "Calculus and Special Functions" and "Transform Techniques" in MR20 Regulations.

**Action Taken:** Action taken accordingly as recommended by the BOS  
**Suggest Methodologies for innovative teaching and evaluation techniques**

1. Adoption of Bloom's taxonomy;
2. 30% of classes teaching by Power Point Presentations
3. Model presentations
4. Conducting Group Discussions among students
5. Comprehensive analytical teaching through Journal Interpretations.
6. NPTEL/MOOC Registrations
7. Remedial Classes



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y. Suresh Kumar  
Chairman - BOS





differential equations, Non-Homogeneous terms of the type  $e^{ax}$ ,  $\sin(ax)$ ,  $\cos(ax)$ , polynomials in  $x$ ,  $e^{ax} V(x)$ ,  $x V(x)$ , Method of variation of parameters.

#### Module – IV: Series Solutions to the Differential Equations

[12 Periods]

Motivation for series solution, Ordinary point and regular singular point of a differential equation, series solution to differential equation around zero, Frobenius Method about zero.

#### Module -V: Differential Calculus

[12 Periods]

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series.

Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers.

#### Text Books:

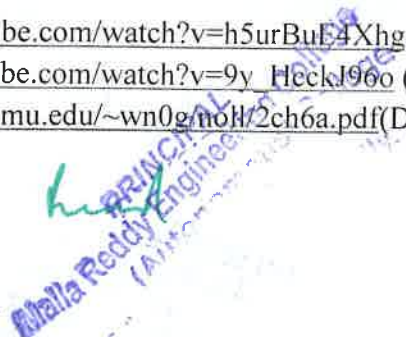
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain Srk Iyengar ,Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.

#### References Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, AffiliatedEast–West press, Reprint 2005.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.

#### E – RESOURCES:

1. [https://www.youtube.com/watch?v=sSjB7ccnM\\_I](https://www.youtube.com/watch?v=sSjB7ccnM_I) (Matrices – System of linear Equations)
2. <https://www.youtube.com/watch?v=h5urBuE4Xhg> (Eigen values and Eigen vectors)
3. [https://www.youtube.com/watch?v=9y\\_HeckJ96o](https://www.youtube.com/watch?v=9y_HeckJ96o) (Quadratic forms)
4. <http://www.math.cmu.edu/~wn0g/nol/2ch6a.pdf>(Differential Calculus)



5. <https://www.intmath.com/differential-equations/1-solving-des.php>(Differential Equations)

#### NPTEL:

1. [https://www.youtube.com/watch?v=NEpvTe3pFlk&list=PLLy\\_2iUCG87BLKl8eISe4fH\\_KdE2\\_j2B\\_T&index=5](https://www.youtube.com/watch?v=NEpvTe3pFlk&list=PLLy_2iUCG87BLKl8eISe4fH_KdE2_j2B_T&index=5) (Matrices – System of linear Equations)
2. <https://www.youtube.com/watch?v=wrSJ5re0TAw> (Eigen values and Eigen vectors)
3. <https://www.youtube.com/watch?v=yuE86XeGhEA> (Quadratic forms)

#### Course Outcomes:

1. The student will be able to find rank of a matrix and analyze solutions of system of linear equations.
2. The student will be able to find Eigen values and Eigen vectors of a matrix, diagonalization a matrix, verification of Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. Formulate and solve the problems of first and higher order differential equations
4. The student will be able to Solve series solution of given differential equation.
5. The student will be able to verify mean value theorems nad maxima and minima of function of two variables.

#### CO- PO Mapping

CO- PO, PSO Mapping												
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			3
CO2	3	2	2	3	2				2			3
CO3	3	2	2	3	2				2			2
CO4	3	2	2	3	3				2			2
CO5	3	2	2	3	3				2			2

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2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code:A0B04	Advanced Calculus (Common for EEE & ECE)	L	T	P
Credits:4		3	1	-

**Pre-requisites:** Differentiation and integration,

**Course Objectives: To Learn**

1. The Methods of solving Partial differential equations.
2. The Beta and Gamma functions.
3. The Evaluation of multiple integrals and their applications in the allied fields.
4. The physical quantities involved in engineering problems related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

**MODULE -I: Partial Differential Equations**

**[12 Periods]**

Formation of partial differential equations by eliminating arbitrary constants or arbitrary function, solutions of first order linear(Lagrange) equations, solutions of non linear first order equations ( four standard types). Equations reducible to linear, Charpits Method.

**MODULE – II: Beta and Gamma Functions**

**[12 Periods]**

Introduction to Improper Integrals, Definition of Beta and Gamma function, properties and other forms. Relation between Beta and Gamma function, Evaluation of Improper Integrals.

**MODULE - III: Multiple Integrals**

**[12 Periods]**

(A) Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form);

(B) Evaluation of Triple Integrals. Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals.

**MODULE - IV: Vector Differentiation**

**[12 Periods]**

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Scalar potential functions. Solenoidal and Irrotational vectors. Vector Identities.

**MODULE – V: Vector Integration**

**[12 periods]**

Line, Surface and Volume Integrals. Green Theorem, Gauss Divergence Theorem and Stokes Theorem (without proofs) and their applications.

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain Srk Iyengar ,Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.

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### Reference Books:

1. Kanti B.Datta, **Mathematical Methods of Science and Engineering**, Cengage Learning
2. Alan Jeffrey, **Mathematics for Engineers and Scientists**, 6<sup>th</sup> Ed, 2013, Chapman & Hall.
3. G.B. Thomas and R.L. Finney, **Calculus and Analytic geometry**, 9<sup>th</sup> Ed, Pearson, Reprint, 2002.
4. S. L. Ross, **Differential Equations**, 3rd Ed., Wiley India, 1984.
5. Amarnath T, **An Elementary Course in Partial Differential Equations**, Narosa Publishing House 2<sup>nd</sup> Ed, 2012.

**Course Outcomes:** After learning the contents of this paper the student must be able to

1. Identify whether the given partial differential equation can be solvable with the methods or not.
2. Solve the problems which are not solvable with the usual methods and solve using Beta and Gamma functions.
3. Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelepiped.
4. Finds the directional derivatives, angle between vectors understands the physical interpretation of vector, solenoidal and irrotational vectors.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

### E-Resources:

#### a. Concerned Website links

1. [https://mat.iitm.ac.in/home/sryedida/public\\_html/caimna/pde/first/partial.html](https://mat.iitm.ac.in/home/sryedida/public_html/caimna/pde/first/partial.html)
2. <https://homepage.tudelft.nl/11r49/documents/wi4006/gammabeta.pdf>
3. [https://math.libretexts.org/Bookshelves/Calculus/Book%3A\\_Calculus\\_\(OpenStax\)/15%3A\\_Multiple\\_Integration/15.2%3A\\_Double\\_Integrals\\_over\\_General\\_Regions](https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(OpenStax)/15%3A_Multiple_Integration/15.2%3A_Double_Integrals_over_General_Regions)
4. [https://math.libretexts.org/Bookshelves/Calculus/Book%3A\\_Calculus\\_\(Apex\)/12%3A\\_Functions\\_of\\_Several\\_Variables/12.06%3A\\_Directional\\_Derivatives](https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(Apex)/12%3A_Functions_of_Several_Variables/12.06%3A_Directional_Derivatives)
5. [https://learn.lboro.ac.uk/archive/olmp/olmp\\_resources/pages/workbooks\\_1\\_50\\_jan2008/Workbook29/29\\_3\\_int\\_vec\\_thms.pdf](https://learn.lboro.ac.uk/archive/olmp/olmp_resources/pages/workbooks_1_50_jan2008/Workbook29/29_3_int_vec_thms.pdf)

#### b. NPTEL :

1. <https://www.digimat.in/nptel/courses/video/111105093/L01.html> (PDE)
2. <https://www.youtube.com/watch?v=JoyvDWZ0aMY> (Beta & Gamma Functions)
3. <https://www.youtube.com/watch?v=mLeeVrv447s> (Multiple Integrals)
4. [https://www.youtube.com/watch?v=M\\_Irtxhbq3E](https://www.youtube.com/watch?v=M_Irtxhbq3E) (Vector Differentiation)
5. <https://www.youtube.com/watch?v=EtA0CK8SwkI> (Vector Integral Theorems)



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CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			3
CO2	3	2	2	3	2				2			3
CO3	3	2	2	3	2				2			2
CO4	3	2	2	3	3				2			2
CO5	3	2	2	3	3				2			2

  
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2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0B08	Complex Variables and Numerical Methods (Common for ECE & EEE)	L	T	P
Credits: 3		3	-	-

**Prerequisites:** Differentiation, Partial differentiation, Integration

**Course Objectives:**

1. To learn the concept of analyticity of a function
2. To learn the concept of evaluation of Integrals
3. To learn the Power series expansions of complex functions and evaluation of contour integrals.
4. The various numerical techniques which are indispensable tools to solve many algebraic and transcendental equations and Interpolation.
5. Numerical methods of solving the ordinary differential equations and Numerical Integration.

**MODULE I: Functions of Complex variable**

**[12 Periods]**

Introduction, Complex functions and its representation on Argand plane, Concepts of limit, Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions, Milne – Thompson method.

**MODULE II: Complex Integration**

**[9 Periods]**

Line integral, Evaluation along a path and by indefinite integration, Cauchy's integral theorem, Cauchy's integral formula, Generalized integral formula.

**MODULE III : Power series expansions of complex functions& Contour Integration**

**[13 periods]**

(A) Radius of convergence, Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point, Isolated singular point, pole of order m, essential singularity.

(B) Residue, Evaluation of residue by formula and by Laurent series, Residue theorem,

Evaluation of integrals by indentation Improper real integrals (a)  $\int_{-\infty}^{\infty} f(x)dx$

(b)  $\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta$

**MODULE IV: : Algebraic and Transcendental equations and Interpolation [14 periods]**

(A) Solution of Algebraic and Transcendental Equations: Introduction-Errors, types of errors. Bisection Method, Method of False Position. The Iteration Method – Newton-Raphson Method



**(B) Interpolation:** Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences-Backward differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton's formulae for interpolation, Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

**MODULE – V:Numerical solution of Ordinary Differential Equations and Numerical Integration** [12 periods]

**Numerical solution of Ordinary Differential Equations** Introduction, Solution by Taylor's series method, Picard's Method of successive Approximations, Euler's Method, Modified Euler's Method, Runge-Kutta Methods.

**Numerical Integration:** Trapezoidal Rule, Simpson's  $1/3^{\text{rd}}$  Rule, Simpson's  $3/8$  Rule.

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain SRK Iyengar ,Advanced engineering mathematics, Narosa publications.
3. M . K Jain, S R K Iyengar, R.K Jain, Numerical Methods for Scientific and Engineering Computation, New age International publishers.

**Reference Books:**

1. Murray Spiegel, Complex variables by Schamus outline series.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.
3. S.S.Sastry, **Introductory Methods of Numerical Analysis**, 5<sup>th</sup> Edition, PHI Learning Private Limited

**E – RESOURCES:**

1. <http://nptel.ac.in/courses/104101002/downloads/lecturenotes/module1/chapter6.pdf> (Numerical Differentiation and Integration)
2. <https://www.youtube.com/watch?v=6vs-pymcsqk> (Regula Falsi Method and Newton Raphson Method )
3. <https://www.youtube.com/watch?v=1pJYZX-tgi0> (Interpolation)
4. <https://www.youtube.com/watch?v=Atv3IsQsak8&pbjreload=101> (Numerical Solution of ODE)
5. <https://www.youtube.com/watch?v=iviiGB5vxLA> (Numerical Integration)
6. <https://www.youtube.com/watch?v=HVHtGVOQySI> (Functions of Complex Variables)
7. <https://www.youtube.com/watch?v=v4yV2t4KBhs> (Complex Integration)

**NPTEL:**

1. <https://www.youtube.com/watch?v=WbmLBRbp0zA> (Bisection Method)



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2. <https://www.youtube.com/watch?v=0K6olBTdcSs> (Regula Falsi and Newton Raphson Method)
3. <https://www.youtube.com/watch?v=KSFnfUYcxol> (Interpolation)
4. <https://www.youtube.com/watch?v=QugqSa3Gl-w&t=2254s> (Numerical Solution of ODE)
5. [https://www.youtube.com/watch?v=NihKCpjx2\\_0&list=PLbMVogVj5nJRILpJJO7KrZa8Ttj4\\_ZAgl](https://www.youtube.com/watch?v=NihKCpjx2_0&list=PLbMVogVj5nJRILpJJO7KrZa8Ttj4_ZAgl) (Numerical Solution of ODE)
6. <https://www.youtube.com/watch?v=hizXlwJO1Ck> (Numerical Integration)
7. <https://www.youtube.com/playlist?list=PLNKx0RorxX44HBsItvZP5CzFX1qCQOwp5> (Complex Analysis)

### Course Outcomes:

1. The student will be able to apply the concept of analyticity of a function
2. The student will be able to evaluate of Integrals
3. The student will be able to find Power series expansions of complex functions and evaluation of contour integrals.
1. The student will be able to find the root of a given equation by various methods and estimate the value for the given data using interpolation.
2. The student will be able to find the numerical solutions for a given ODE's and evaluations of integrals using numerical techniques.

### CO- PO Mapping

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			1
CO2	2	2	2	3	2				2			1
CO3	2	2	2	3	2				2			1
CO4	3	2	2	3	3				2			2
CO5	2	2	2	3	3				2			2

  
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<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>B.Tech. I Semester</b>		
<b>Code: A0B01</b>	<b>Linear Algebra and Numerical Methods I B. Tech I Sem  (Common For CSE &amp; IT)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 4</b>		<b>3</b>	<b>1</b>	<b>-</b>

**Prerequisites:** Matrices, Differentiation and Integration.

**Course Objectives:**

1. To learn types of matrices, Concept of rank of a matrix and applying the concept of rank to know the consistency of linear equations and to find all possible solutions, if exist.
2. To learn concept of Eigen values and Eigen vectors of a matrix, diagonalization of a matrix, Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. To learn various methods to find roots of an equation.
4. To learn Concept of finite differences and to estimate the value for the given data using interpolation.
5. To learn Solving ordinary differential equations and evaluation of integrals using numerical techniques.

**MODULE I: Matrix algebra**

**[12 Periods]**

Vector Space, basis, linear dependence and independence (Only Definitions)

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew- Hermitian; orthogonal matrices; Unitary Matrices; Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; solving system of Homogeneous and Non-Homogeneous linear equations, LU – Decomposition Method.

**MODULE II: Eigen Values and Eigen Vectors**

**[12 Periods]**

Eigen values , Eigen vectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem; Singular Value Decomposition.

**Quadratic forms:** Nature, rank, index and signature of the Quadratic Form, Linear Transformation and Orthogonal Transformation, Reduction of Quadratic form to canonical forms by Orthogonal Transformation Method.

**MODULE III: : Algebraic & Transcendental equations**

**[12 Periods]**

**(A)** Solution of Algebraic and Transcendental Equations: Introduction-Errors, types of errors. Bisection Method, Method of False Position, Newton-Raphson Method.

**(B)** The Iteration Method ,Ramanujan's method to find smallest root of Equation. Jacobi's Iteration method. Gauss seidel Iteration method.

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#### MODULE IV: Interpolation

[12 Periods]

Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences-Central differences - Symbolic relations and separation of symbols. Differences of a polynomial-Newton's formulae for interpolation; Central difference interpolation Formulae – Gauss Central Difference Formulae ; Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

#### MODULE V: Numerical solution of Ordinary Differential Equations and Numerical Integration

[12 Periods]

**Numerical solution of Ordinary Differential Equations :** Introduction-Solution of Ordinary Differential Equation by Taylor's series method - Picard's Method of successive Approximations - Euler's Method-Modified Euler's Method – Runge-Kutta Methods.

**Numerical Integration:** Trapezoidal Rule, Simpson's  $1/3^{\text{rd}}$  Rule, Simpson's  $3/8$  Rule.

#### TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. M . K Jain, S R K Iyengar, R.K Jain, Numerical Methods for Scientific and Engineering Computation, New age International publishers.
5. S.S.Sastry, Introductory Methods of Numerical Analysis, 5<sup>th</sup> Edition, PHI Learning Private Limited

#### REFERENCES

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

#### E – RESOURCES

1. [https://www.youtube.com/watch?v=sSjB7ccnM\\_I](https://www.youtube.com/watch?v=sSjB7ccnM_I) (Matrices – System of linear Equations)
2. <https://www.youtube.com/watch?v=h5urBuE4Xhg> (Eigen values and Eigen vectors)
3. [https://www.youtube.com/watch?v=9y\\_HeckJ96o](https://www.youtube.com/watch?v=9y_HeckJ96o) (Quadratic forms)
4. [https://www.youtube.com/watch?v=3j0c\\_FhOt5U](https://www.youtube.com/watch?v=3j0c_FhOt5U) (Bisection Method)



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5. <https://www.youtube.com/watch?v=6vs-pymcsqk> (Regula Falsi Method and Newton Raphson Method )
6. <https://www.youtube.com/watch?v=lpJYZX-tgi0> (Interpolation)
7. <https://www.youtube.com/watch?v=Atv3IsQsak8&pbjreload=101> (Numerical Solution of ODE)
8. <https://www.youtube.com/watch?v=iviiGB5vxLA> (Numerical Integration)

#### NPTEL

1. [https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy\\_2iUCG87BLKl8eISe4fHKdE2\\_j2B\\_T&index=5](https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2B_T&index=5) (Matrices – System of linear Equations)
2. <https://www.youtube.com/watch?v=wrSJ5re0TAw> (Eigen values and Eigen vectors)
3. <https://www.youtube.com/watch?v=yuE86XeGhEA> (Quadratic forms)
4. <https://www.youtube.com/watch?v=WbmLBRbp0zA> (Bisection Method)
5. <https://www.youtube.com/watch?v=0K6olBTdcSs> (Regula Falsi and Newton Raphson Method)
6. <https://www.youtube.com/watch?v=KSFnfUYcxoI> (Interpolation)
7. <https://www.youtube.com/watch?v=QugqSa3Gl-w&t=2254s> (Numerical Solution of ODE)
8. [https://www.youtube.com/watch?v=NihKCpJx2\\_0&list=PLbMVogVj5nJRILpJJO7KrZa8Ttj4\\_ZAgI](https://www.youtube.com/watch?v=NihKCpJx2_0&list=PLbMVogVj5nJRILpJJO7KrZa8Ttj4_ZAgI) (Numerical Solution of ODE)
9. <https://www.youtube.com/watch?v=hizXlwJOlCk> (Numerical Integration)

#### Course Outcomes:

1. The student will be able to find rank of a matrix and analyze solutions of system of linear equations.
2. The student will be able to find Eigen values and Eigen vectors of a matrix, diagonalization a matrix, verification of Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. The student will be able to find the root of a given equation by various methods.
4. The student will be able to estimate the value for the given data using interpolation.
5. The student will be able to find the numerical solutions for a given ODE's and evaluations of integrals using numerical techniques.



## CO- PO Mapping

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			1
CO2	2	2	2	3	2				2			1
CO3	2	2	2	3	2				2			1
CO4	3	2	2	3	3				2			2
CO5	2	2	2	3	3				2			2



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2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code:A0B02	Probability and Statistics (Common for CSE & IT)	L	T	P
Credits: 3		3	-	-

**Prerequisites:** Basic Probability

**Course Objectives:**

1. Define event, outcome, trial, simple event, sample space and calculate the probability that an event will occur.
2. To learn the random variables and its distributions.
3. Statistical analyses are very often concerned with the difference between means.
4. Investigate the variability in sample statistics from sample to sample
5. Identify the direction and strength of a linear correlation between two factors.

**MODULE I: Probability:**

**[12 Periods]**

Introduction to Probability ;Events, sample space, mutually exclusive events. Exhaustive events. Addition theorem for 2& n events and their related problems. Dependent and Independent events, conditional probability, multiplication theorem. Boole's inequality, Baye's Theorem.

**MODULE II: Random variables:**

**[12 Periods]**

Discrete Probability distributions. Bernoulli, Binomial, Poission, Geometric distributions of their mean and variance, moment generating function-related problems. Continuous probability distributions: Normal distribution, Uniform distribution of their mean and variance, moment generating function, Central Limit theorem.

**MODULE III: Sampling Distributions:**

**[14 Periods]**

(A) Definitions of population-sampling-statistic, parameter. Types of sampling, expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance. Parameter estimations – likelihood estimate, point estimation and interval estimation

(B) **Testing of hypothesis:** Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, and Level of significance. One sided test, two-sided test.

**Large sample tests:**

- (i) Test of significance for single mean
- (ii) Test of significance for difference of means
- (iii) Test of significance for single proportion
- (iv) Test of significance for difference of proportions

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**MODULE IV: Small sample tests:****[12 Periods]**

Student t-distribution, its properties and its assumptions, Test of significance difference between sample mean and population mean; difference between means of two small samples, Snedecor's, F- distribution and its properties. Test of equality of two population variances, Chi-square distribution, its properties, Chi-square test of goodness of fit, Independence of attributes.

**MODULE V: Correlation, Regression:****[10 Periods]**

Correlation, Coefficient of correlation, the rank correlation. Regression, Regression Coefficient, The lines of regression: simple regression. Multiple regression for three variables.

**TEXT BOOKS**

1. Walpole, Probability & Statistics, for Engineers & Scientists, 8th Edition, Pearson Education.
2. Paul A Mayer Introductory Probability and Statistical Applications, John Wiley Publications.
3. Monte Geometry, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley Publications.

**REFERENCES**

1. P. G. Hole, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

**E – RESOURCES****a) Concerned Website links:**

1. <http://www.csie.ntu.edu.tw/~sdlin/download/Probability%20&%20Statistics.pdf> (Probability & Statistics for Engineers & Scientists text book)
2. [http://www.stat.pitt.edu/stoffer/tsa4/intro\\_prob.pdf](http://www.stat.pitt.edu/stoffer/tsa4/intro_prob.pdf) (Random variables and its distributions)
3. <http://users.wfu.edu/Cottrell/ecn215/sampling.pdf> (Notes on Sampling and hypothesis testing)

**b) Concerned Journals/ Magazines links:**

1. <http://www.pnas.org/content/93/9/3772.full.pdf> (Hypothesis testing and earthquake prediction)
2. <http://nsuworks.nova.edu/cgi/viewcontent.cgi?article=2373&context=tqr> (Sampling Theory)
3. <https://sci-hub.cc/10.1111/j.1540-6261.1996.tb05219.x> (probability Distributions)

**c) NPTEL Videos:**

1. <http://nptel.ac.in/courses/117105085/> (Introduction to theory of probability)



2. <http://nptel.ac.in/courses/117105085/9> (Mean and variance of random variables)

3. <http://nptel.ac.in/courses/111105041/33> (Testing of hypothesis)

#### Course Outcomes:

1. The students will understand and appreciate the role of P&S in data analytics and big data analysis.
2. Students would be able to find the Probability in certain realistic situation
3. Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variables Involved in the probability models. It is quite useful for all branches of engineering.
4. The student would be able to calculate mean and proportions (large and small sample) and to make Important decisions from few samples which are taken out of unmanageably huge populations.
5. Students will understand how to forecast the future observations.

#### CO- PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3		3		2	2			1
CO2	3	3	3		2			2	1	1	1
CO3	3	2	3		2	1	1	1			1
CO4	3	2	2	2	2	2		3	1	1	3
CO5	3	3	2	1	3	1	2	2	1	1	3

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## MODULE V: Queuing Theory

[12 Periods]

Structure of a queuing system, operating Characteristics of queuing system. Transient and Steady states, Terminology of Queuing systems. Arrival and service Processes, Pure Birth-Death process. Deterministic queuing Models,  $(M/M/1):(\infty: \text{FIFO})$  Model,  $(M/M/1):(N: \text{FIFO})$  Model.

### Text Books:

1. Monte Gomery, "Applied Statistics and Probability for Engineers", 6<sup>th</sup> Edition, Wiley Publications
2. J K Sharma, "Operations research Theory and applications" Macmillan publishers India limited, 4<sup>th</sup> edition.
3. Paul A Mayer Introductory Probability and Statistical Applications, John Wiley Publication's

### Reference Books:

1. Willam Feller : "Introduction to Probability theory and its applications". Volume –I, Wiley
2. Goon AM, Gupta MK, Das Gupta B : "Fundamentals of Statistics", Vol-I, the World Press Pvt.Ltd. , Kolakota
3. V.K.Kapoor and S.C.Gupta: "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi

### E – RESOURCES:

1. <https://www.youtube.com/watch?v=RgKy7URFx1c2>.
2. <https://www.youtube.com/watch?v=h0bdo06qNVw>
3. <https://www.youtube.com/watch?v=LRkqW3QraBA>
4. <https://www.youtube.com/watch?v=ItOuvM2Kmd4>
5. <https://www.youtube.com/watch?v=rSZWig173xM>

### Course Outcomes:

After completing the modules, students will be able to:

1. Find out the existence of a statistically significant difference among several group means.
2. Make use of the basics of the Design of Experiments such as randomization and blocking.
3. Solve Transportation and Assignment Problems.
4. Understand the usage of Game Theory for Solving Business Problems.
5. Understand basic characteristic features of a queuing system and acquire skills in analyzing queuing models.



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**CO- PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3		2	1		2			1
CO2	3	3	1	1	2	1	1		1	1	1
CO3	3	3	3	1	1			2			1
CO4	2	3	3		2			2	1		2
CO5	3	3	3	2	2			2	1		1

  
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<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>B.Tech. I Semester</b>		
<b>Code:A0B05</b>	<b>Linear Algebra and Differential Equations  (Common For CE, ME&amp;MINING)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 4</b>		<b>3</b>	<b>1</b>	<b>-</b>

**Prerequisites:** Matrices, Differentiation, and Integration

**Course Objectives:**

1. To learn rank of the matrix and its application to consistency of system of linear equations
2. To learn Eigen Values, Eigen Vectors and nature of Quadratic forms.
3. To learn the concept of the mean value theorems, partial differentiation and maxima and minima.
4. To learn methods of solving differential equations and its applications to basic engineering problems.
5. To learn basics of partial differential equations and the standard forms of partial differential equations.

**Module -I: Matrix algebra**

**[12 Periods]**

Vector Space, basis, linear dependence and independence (Only Definitions)

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew- Hermitian; orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; solving system of Homogeneous and Non-Homogeneous linear equations. LU - Decomposition Method.

**MODULE II: Eigen Values and Eigen Vectors**

**[12 Periods]**

Eigen values , Eigen vectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem; Singular Value Decomposition.

**Quadratic forms:** Nature, rank, index and signature of the Quadratic Form, Linear Transformation and Orthogonal Transformation, Reduction of Quadratic form to canonical forms by Orthogonal Transformation Method.

**Module - III: Differential Calculus**

**[12 Periods]**

Mean value theorems: Rolle's theorem and Lagrange's Mean value theorem with their Geometrical Interpretation and its applications, Cauchy's Mean value Theorem. Taylor's Series. Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers.

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#### Module –IV: Ordinary Differential Equations

[12 Periods]

**First Order and First Degree ODE:** Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

**Second and Higher Order ODE with Constant Coefficients:** Introduction-Rules for finding complementary function and particular integral. Solution of Homogenous, non-homogeneous differential equations, Non-Homogeneous terms of the type  $e^{ax}$ ,  $\sin(ax)$ ,  $\cos(ax)$ , polynomials in  $x$ ,  $e^{ax} V(x)$ ,  $x V(x)$ , Method of variation of parameters.

#### Module – V: Partial Differential Equations

[12 Periods]

Formation of partial differential equations by eliminating arbitrary constants or arbitrary function, solutions of first order linear (Lagrange) equations, solutions of non linear first order equations (four standard types). Equations reducible to linear, Charpit's Method.

#### Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain SRK Iyengar , Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.

#### Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

#### E – RESOURCES:

1. <https://www.mathplanet.com/education/algebra-2/matrices/how-to-operate-with-matrices> (Systems of linear equations, matrices)
2. <http://math.mit.edu/~gs/linearalgebra/ila0601.pdf> (Eigen values, Eigen vectors)
3. <http://www.math.cmu.edu/~wn0g/noll/2ch6a.pdf> (Differential Calculus)
4. <https://www.intmath.com/differential-equations/1-solving-des.php> (Differential Equations)
5. <https://www.math.uni-leipzig.de/~miersemann/pdebook.pdf> (Partial differential Equations)



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**NPTEL:**

1. [https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy\\_2iUCG87BLKl8eISe4fHKdE2\\_j2B\\_T&index=5](https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2B_T&index=5) (Matrices – System of linear Equations)
2. <https://www.youtube.com/watch?v=wrSJ5re0TAw> (Eigen values and Eigen vectors)
3. <https://www.youtube.com/watch?v=yuE86XeGhEA> (Quadratic forms)

**Course Outcomes:**

1. The student will be able to find rank of a matrix and analyze solutions of system of linear equations.
2. The student will be able to find Eigen values and Eigen vectors of a matrix, diagonalization a matrix, verification of Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. The student will be able to verify mean value theorems and maxima and minima of function of two variables.
4. Formulate and solve the problems of first and higher order differential equations
5. Apply knowledge of Partial differential equations in real world problems.

**CO- PO Mapping:**

<b>CO- PO, PSO Mapping</b> (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
<b>COS</b>	<b>Programme Outcomes(POs)</b>											
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>CO1</b>	3	2	2	3	3				2			3
<b>CO2</b>	3	2	2	3	2				2			3
<b>CO3</b>	3	2	2	3	2				2			2
<b>CO4</b>	3	2	2	3	3				2			2
<b>CO5</b>	3	2	2	3	3				2			2

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2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code:A0B06	Vector Calculus and Numerical Techniques	L	T	P
Credits: 4	(Common For CE,ME&MINING)	3	1	-

**Pre- requisite:** Basics of vectors, Differentiation and Integration.

**Course Objectives: To learn**

1. The physical quantities involved in engineering field related to vector valued functions.
2. The basic properties of vector valued functions and their applications to line, surface and volume integrals.
3. The various numerical techniques which are indispensable tools to solve many algebraic and transcendental equations.
4. Numerical methods of solving the ordinary differential equations.
5. Evaluation of PDE and their applications by using numerical techniques.

**MODULE – I: Vector Differentiation [12 periods]**

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives,. Scalar potential functions. Solenoidal and Irrotational vectors. Vector Identities.

**MODULE – II: Vector Integration [12 periods]**

Line, Surface and Volume Integrals. Green Theorem, Gauss Divergence Theorem and Stokes Theorem (without proofs) and their applications.

**MODULE III: : Algebraic and Transcendental equations and Interpolation [12 periods]**

(A) Solution of Algebraic and Transcendental Equations: Introduction-Errors, types of errors. Bisection

Method, Method of False Position. The Iteration Method – Newton-Raphson Method

(B) **Interpolation:** Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences-Backward differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton's formulae for interpolation, Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

**MODULE – IV: Numerical solution of Ordinary Differential Equations and Numerical Integration [12 periods]**

**Numerical solution of Ordinary Differential Equations** Introduction-Solution by Taylor's series method - Picard's Method of successive Approximations, Euler's Method,Modified Euler's Method – Runge-Kutta Methods.

**Numerical Integration:** Trapezoidal Rule, Simpson's  $1/3^{\text{rd}}$  Rule, Simpson's  $3/8$  Rule.

**MODULE – V: Numerical solution of PDE [12 periods]**

Classification of second order equations , Finite difference approximations to derivatives , - standard 5-point formula ,diagonal 5-point formula , solution of Laplace equation, Solution of Poisson's equation. Solution of one-dimensional heat, wave equations (by Crank-Nicolson explicit/implicit formula only).

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### Text Books:

- 1) B.S. Grewal, **Higher Engineering Mathematics**, Khanna Publishers, 36th Edition, 2010.
- 2) R K Jain S R Klyengar, **Advanced engineering mathematics**, Narosa publications.
- 3) Erwin Kreyszig, **Advanced Engineering Mathematics**, Wiley publications.
- 4) M. K Jain, S R K lyengar, R.K Jain, **Numerical Methods for Scientific and Engineering Computation**, New age International publishers.
- 5) S.S.Sastry, **Introductory Methods of Numerical Analysis**, 5<sup>th</sup> Edition, PHI Learning Private Limited

### Reference Books:

1. Kanti B. Datta "Mathematical Methods of Science and Engineering", Cengage Learning.
2. Alan Jeffrey "Mathematics for Engineers and Scientists", Chapman & Hall/ CRC, 6<sup>th</sup> Edition 2013
3. Michael Greenberg "Advanced Engineering Mathematics", Pearson Education Second Edition.
4. G.B. Thomas and R.L. Finney, **Calculus and Analytic geometry**, 9th Edition, Pearson, Reprint, 2002

### E Resources:

#### a) Concerned Website links

1. <http://www.mecmath.net/calc3book.pdf> (Vector Calculus)
2. [http://www.simumath.com/library/book.html?code=Alg\\_Equations\\_Examples](http://www.simumath.com/library/book.html?code=Alg_Equations_Examples) (Algebraic and transcendental equation text book by YURG BERENGARD)
3. [http://jupiter.math.nctu.edu.tw/~smchang/9602/NA\\_lecture\\_note.pdf](http://jupiter.math.nctu.edu.tw/~smchang/9602/NA_lecture_note.pdf) (Interpolation)
4. <http://nptel.ac.in/courses/104101002/downloads/lecturenotes/module1/chapter6.pdf> (Numerical Differentiation and Integration)
5. <http://www.sam.math.ethz.ch/~hiptmair/tmp/NPDE10.pdf> (Numerical Solution of Partial Differential Equations)

#### b) Concerned Journals/Magazines links

1. [https://www.jstor.org/stable/27953736?seq=1#page\\_scan\\_tab\\_contents](https://www.jstor.org/stable/27953736?seq=1#page_scan_tab_contents) (Algebraic and transcendental equation by William L. Schaaf)
2. <http://www.ijcsi.org/papers/IJCSI-9-6-2-413-419.pdf> (Algebraic and transcendental equation by Md. Golam Moazzam)
3. <http://www.iosrjournals.org/iosr-jm/papers/Vol6-issue6/J0665862.pdf> (Interpolation)

#### c) NPTEL Videos

1. <http://nptel.ac.in/courses/122102009> (Algebraic and transcendental equation)
2. <http://nptel.ac.in/courses/112104035/14> (Mathematical methods in engineering and science by Prof. Bhaskar Dasgupta)
3. <http://nptel.ac.in/courses/111107063> (Numerical solution of Ordinary Differential Equations)
4. <http://nptel.ac.in/courses/111105038> (Numerical Solution of Partial Differential Equations)

### Course Outcomes:

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

1. Apply the concept of Gradient, Divergence and Curl of a vector valued functions and



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- scalar valued functions in engineering and physical problems.
2. Apply vector integral theorems in engineering and physical problems.
  3. Apply numerical methods to solve some algebraic and transcendental equations to the desired level of accuracy and by applying interpolation concept to evaluate missed data in data analysis.
  4. Apply differential equations in engineering-oriented problems and to observe patterns by using numerical techniques.
  5. To find out the Numerical solution of partial differential equations.

### Co-Po Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	3	3	2	2								1
CO 2	3	3	2	3								
CO 3	3	3	3	3								1
CO 4	3	3	3	3								
CO 5	3	3	3	3								

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<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>B.Tech. III Semester</b>		
<b>Code:A0B02</b>	<b>Probability and Statistics (Common for CE,ME)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>-</b>	<b>-</b>

**Prerequisites:** Basic Probability

**Course Objectives:**

1. Define event, outcome, trial, simple event, sample space and calculate the probability that an event will occur.
2. To learn the random variables and its distributions.
3. Statistical analyses are very often concerned with the difference between means.
4. Investigate the variability in sample statistics from sample to sample
5. Identify the direction and strength of a linear correlation between two factors.

**MODULE I: Probability:**

**[12 Periods]**

Introduction to Probability ;Events, sample space, mutually exclusive events. Exhaustive events. Addition theorem for 2& n events and their related problems. Dependent and Independent events, conditional probability, multiplication theorem. Boole's inequality, Baye's Theorem.

**MODULE II: Random variables:**

**[12 Periods]**

Discrete Probability distributions. Bernoulli, Binomial, Poission, Geometric distributions of their mean and variance, moment generating function-related problems. Continuous probability distributions: Normal distribution, Uniform distribution of their mean and variance, moment generating function, Central Limit theorem.

**MODULE III: Sampling Distributions:**

**[14 Periods]**

(A) Definitions of population-sampling-statistic, parameter. Types of sampling, expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance. Parameter estimations – likelihood estimate, point estimation and interval estimation

(B) **Testing of hypothesis:** Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, and Level of significance. One sided test, two-sided test.

**Large sample tests:**

- (i) Test of significance for single mean
- (ii) Test of significance for difference of means
- (iii) Test of significance for single proportion
- (iv) Test of significance for difference of proportions

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**MODULE IV: Small sample tests:****[12 Periods]**

Student t-distribution, its properties and its assumptions, Test of significance difference between sample mean and population mean; difference between means of two small samples, Snedecor's, F- distribution and its properties. Test of equality of two population variances, Chi-square distribution, its properties, Chi-square test of goodness of fit, Independence of attributes.

**MODULE V: Correlation, Regression:****[10 Periods]**

Correlation, Coefficient of correlation, the rank correlation. Regression, Regression Coefficient, The lines of regression: simple regression. Multiple regression for three variables.

**TEXT BOOKS**

1. Walpole, Probability & Statistics, for Engineers & Scientists, 8th Edition, Pearson Education.
2. Paul A Mayer Introductory Probability and Statistical Applications, John Wiley Publications.
3. Monte Geometry, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley Publications.

**REFERENCES**

1. P. G. Hole, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

**E – RESOURCES****a) Concerned Website links:**

1. <http://www.csie.ntu.edu.tw/~sdlin/download/Probability%20&%20Statistics.pdf> (Probability & Statistics for Engineers & Scientists text book)
2. [http://www.stat.pitt.edu/stoffer/tsa4/intro\\_prob.pdf](http://www.stat.pitt.edu/stoffer/tsa4/intro_prob.pdf) (Random variables and its distributions)
3. <http://users.wfu.edu/Cottrell/ecn215/sampling.pdf> (Notes on Sampling and hypothesis testing)

**b) Concerned Journals/ Magazines links:**

1. <http://www.pnas.org/content/93/9/3772.full.pdf> (Hypothesis testing and earthquake prediction)
2. <http://nsuworks.nova.edu/cgi/viewcontent.cgi?article=2373&context=tqr> (Sampling Theory)
3. <https://sci-hub.cc/10.1111/j.1540-6261.1996.tb05219.x> (probability Distributions)

**c) NPTEL Videos:**

1. <http://nptel.ac.in/courses/117105085/> (Introduction to theory of probability)



2. <http://nptel.ac.in/courses/117105085/9> (Mean and variance of random variables)

3. <http://nptel.ac.in/courses/111105041/33> (Testing of hypothesis)

#### Course Outcomes:

1. The students will understand and appreciate the role of P&S in data analytics and big data analysis.
2. Students would be able to find the Probability in certain realistic situation
3. Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variables Involved in the probability models. It is quite useful for all branches of engineering.
4. The student would be able to calculate mean and proportions (large and small sample) and to make Important decisions from few samples which are taken out of unmanageably huge populations.
5. Students will understand how to forecast the future observations.

#### CO- PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3		3		2	2			1
CO2	3	3	3		2			2	1	1	1
CO3	3	2	3		2	1	1	1			1
CO4	3	2	2	2	2	2		3	1	1	3
CO5	3	3	2	1	3	1	2	2	1	1	3

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2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0B02	Probability and Statistics (Common for MINING)	L	T	P
Credits: 3		3	-	-

**Prerequisites:** Basic Probability

**Course Objectives:**

1. Define event, outcome, trial, simple event, sample space and calculate the probability that an event will occur.
2. To learn the random variables and its distributions.
3. Statistical analyses are very often concerned with the difference between means.
4. Investigate the variability in sample statistics from sample to sample
5. Identify the direction and strength of a linear correlation between two factors.

**MODULE I: Probability:**

**[12 Periods]**

Introduction to Probability ;Events, sample space, mutually exclusive events. Exhaustive events. Addition theorem for 2& n events and their related problems. Dependent and Independent events, conditional probability, multiplication theorem. Boole's inequality, Baye's Theorem.

**MODULE II: Random variables:**

**[12 Periods]**

Discrete Probability distributions. Bernoulli, Binomial, Poission, Geometric distributions of their mean and variance, moment generating function–related problems. Continuous probability distributions: Normal distribution, Uniform distribution of their mean and variance, moment generating function, Central Limit theorem.

**MODULE III: Sampling Distributions:**

**[14 Periods]**

**(A)** Definitions of population-sampling-statistic, parameter. Types of sampling, expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance. Parameter estimations – likelihood estimate, point estimation and interval estimation

**(B) Testing of hypothesis:** Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, and Level of significance. One sided test, two-sided test.

**Large sample tests:**

- (i) Test of significance for single mean
- (ii) Test of significance for difference of means
- (iii) Test of significance for single proportion
- (iv) Test of significance for difference of proportions

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**MODULE IV: Small sample tests:****[12 Periods]**

Student t-distribution, its properties and its assumptions, Test of significance difference between sample mean and population mean; difference between means of two small samples, Snedecor's, F- distribution and its properties. Test of equality of two population variances, Chi-square distribution, its properties, Chi-square test of goodness of fit, Independence of attributes.

**MODULE V: Correlation, Regression:****[10 Periods]**

Correlation, Coefficient of correlation, the rank correlation. Regression, Regression Coefficient, The lines of regression: simple regression. Multiple regression for three variables.

**TEXT BOOKS**

1. Walpole, Probability & Statistics, for Engineers & Scientists, 8th Edition, Pearson Education.
2. Paul A Mayer Introductory Probability and Statistical Applications, John Wiley Publications.
3. Monte Geometry, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley Publications.

**REFERENCES**

1. P. G. Hole, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

**E – RESOURCES****a) Concerned Website links:**

1. <http://www.csie.ntu.edu.tw/~sdlin/download/Probability%20&%20Statistics.pdf> (Probability & Statistics for Engineers & Scientists text book)
2. [http://www.stat.pitt.edu/stoffer/tsa4/intro\\_prob.pdf](http://www.stat.pitt.edu/stoffer/tsa4/intro_prob.pdf) (Random variables and its distributions)
3. <http://users.wfu.edu/Cottrell/ecn215/sampling.pdf> (Notes on Sampling and hypothesis testing)

**b) Concerned Journals/ Magazines links:**

1. <http://www.pnas.org/content/93/9/3772.full.pdf> (Hypothesis testing and earthquake prediction)
2. <http://nsuworks.nova.edu/cgi/viewcontent.cgi?article=2373&context=tqr> (Sampling Theory)
3. <https://sci-hub.cc/10.1111/j.1540-6261.1996.tb05219.x> (probability Distributions)

**c) NPTEL Videos:**

1. <http://nptel.ac.in/courses/117105085/> (Introduction to theory of probability)



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2. <http://nptel.ac.in/courses/117105085/9> (Mean and variance of random variables)

3. <http://nptel.ac.in/courses/111105041/33> (Testing of hypothesis)

#### Course Outcomes:

1. The students will understand and appreciate the role of P&S in data analytics and big data analysis.
2. Students would be able to find the Probability in certain realistic situation
3. Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variables Involved in the probability models. It is quite useful for all branches of engineering.
4. The student would be able to calculate mean and proportions (large and small sample) and to make Important decisions from few samples which are taken out of unmanageably huge populations.
5. Students will understand how to forecast the future observations.

#### CO- PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3		3		2	2			1
CO2	3	3	3		2			2	1	1	1
CO3	3	2	3		2	1	1	1			1
CO4	3	2	2	2	2	2		3	1	1	3
CO5	3	3	2	1	3	1	2	2	1	1	3

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<b>2020-21 Onwards (MR-20)</b>	<b>MALLA REDDY ENGINEERING COLLEGE (Autonomous)</b>	<b>B.Tech. IV Semester</b>		
<b>Code:A0B22</b>	<b>Statistics for Data Science CSE (Data Science)</b>	<b>L</b>	<b>T</b>	<b>P</b>
<b>Credits: 3</b>		<b>3</b>	<b>0</b>	<b>-</b>

**Pre-requisite:** Basic concepts of statistics

**Course Objectives:**

1. To learn Analysis of variance, ANCOVA and design of experiments in manufacturing firms.
2. To learn advanced design of experiments and their applications.
3. To learn quality control, Six Sigma and its importance to real life problems.
4. To learn multiple regression and Application of Time-series.
5. To learn MANOVA and multivariate analysis

**Module -I: Analysis of Variance & Analysis of Co-variance [10 Periods]**

Analysis of Variance (ANOVA): one-way & two-way ANOVA and multiple comparisons. Analysis of Co-variance (ANCOVA) (Only one way). Conducting ANCOVA – Two way Comparison of the efficiencies of above designs.

**Module -II: Design of Experiments [14 Periods]**

Design of Experiments: Importance and applications of design of experiments. Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Introduction to Factorial design -  $2^2$  and  $2^n$  Factorial design.

**Module -III: Statistical Quality Control [12 Periods]**

**A:**Importance of SQC in industry. Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p, np, c&d charts with fixed and varying sample sizes).

**B:**Interpretation of control charts. Natural tolerance limits and specification limits process capability index. Single and double sampling plans, Concept of Six sigma and its importance.

**Module -IV: Multiple Regression and Time Series [12 Periods]**

Multiple Regressions for n- independent variables

**Time Series :** Fitting a trend line to a time series, Method of least Squares and Method of Moving Averages, Measure of Seasonal Variation.

**Module -V: Multi Variate Analysis [12 Periods]**

Introduction to Multivariate analysis, Nature of Multivariate analysis, Classification of Multivariate techniques: PCA , Factor analysis, Cluster Analysis, Discriminant Analysis, Mahalanobis D square, MANOVA , Nearest neighborhood method.

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**Text Books:**

1. Monte Gomery, “**Applied Statistics and Probability for Engineers**”, 6<sup>th</sup> Edition, Wiley Publications.
2. Paul A Maeyer Introductory Probability and Statistical Applications, John Wiley Publications.
3. Subhash Sharma, Applied Multivariate Techniques, First Edition.

**Reference Books:**

1. Willam Feller :“**Introduction to Probability theory and its applications**”. Volume –I ,Wiley 2.
2. Goon AM, Gupta MK, Das Gupta B :“**Fundamentals of Statistics**”, Vol-I, the World Press Pvt.Ltd. , Kolakota.
3. V.K.Kapoor and S.C.Gupta: “**Fundamentals of Mathematical Statistics**”, Sultan Chand & Sons, New Delhi

**E Resources****a) Concerned Website links**

1. <https://onlinecourses.science.psu.edu/stat502/node/183> (ANCOVA)
2. <http://www.uoguelph.ca/~dsparlin/sqc.htm> (Statistical Quality control)
3. [http://irh.inf.unideb.hu/~jsztrik/education/16/SOR\\_Main\\_Angol.pdf](http://irh.inf.unideb.hu/~jsztrik/education/16/SOR_Main_Angol.pdf) (Basic Queueing Theory)
4. <https://www.math.kth.se/matstat/gru/sf2943/ts.pdf> (Time Series Analysis)

**b) Concerned Journals/Magazines links**

1. <https://sci-hub.cc/10.1007/BF02294394> ( ANOVA and ANCOVA)
2. <http://www.ijpcsonline.com/files/34-781.pdf> (Design of Experiments)
3. [https://sci-hub.cc/10.1016/0377-2217\(95\)00069-0](https://sci-hub.cc/10.1016/0377-2217(95)00069-0) (Statistical Quality control)

**c) NPTEL Videos**

1. <http://nptel.ac.in/courses/110106064/5> (Introduction to Data Analysis)
2. <http://nptel.ac.in/courses/111104075/> (ANOVA and Design of Experiments)
3. <http://nptel.ac.in/courses/110105039/> (Quality management)
4. <http://nptel.ac.in/courses/105105045/40> (correlation and regression Analysis)
5. <https://www.youtube.com/watch?v=RtTfFhK0WE0> (MANOVA)

**Course Outcomes:**

At end of the course student can able to

1. Perform Analysis of variance, ANCOVA and design of experiments in manufacturing firms.
2. Understand advanced design of experiments and their applications.
3. Understand concept of quality control , Six Sigma and its importance to real life problems.
4. Understand the concept of multiple regression and Application of Time-series.
5. Perform MANOVA and multivariate analysis



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## CO- PO Mapping

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			1
CO2	2	2	2	3	2				2			1
CO3	2	2	2	3	2				2			1
CO4	3	2	2	3	3				2			2
CO5	2	2	2	3	3				2			2

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2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code: A0B23	NUMBER THEORY CSE (Cyber Security)	L	T	P
Credits: 3		3	0	-

**Pre-requisite:** Basics of Number theory

**Course Objectives:**

1. To learn linear Diophantine equation and Fundamental theorem of Arithmetic
2. To learn linear congruence and applications of congruence
3. To learn Arithmetic functions
4. To learn primitive roots and determination of integers having primitive roots
5. To learn Quadratic Congruences and Quadratic Reciprocity Law

**MODULE-I: Divisibility**

Greatest Common divisor, Least common multiple, linear Diophantine equation  
Fundamental theorem of Arithmetic, Some questions regarding primes.

[12 Periods]

**Module -II: Congruences**

Definition, Residue system, tests of divisibility, linear congruences, solving polynomial congruences, An application of congruences to Diophantine equations.

[12 Periods]

**Module -III: Arithmetic Functions**

The function  $\tau$  and, The Mobius function, Multiplicative Arithmetic functions, Inversion formula, Greatest integer function

[12 Periods]

**Module -IV: Primitive Roots**

Exponents, Primitive roots modulo a prime, determination of integers having primitive roots, Indices.

[12 Periods]

**Module -V: Quadratic Congruences and Quadratic Reciprocity Law**

Euler's criterion, Legendre symbol and its properties, Gauss lemma, Quadratic reciprocity law, some applications of quadratic reciprocity, Jacobi symbol.

[12 Periods]

**Text Books.**

1. Burton, David M. Elementary number theory. Second edition. W. C. Brown Publishers, Dubuque, IA, 1989.
2. S B Malik Basic Number theory Second revised edition, Vikas publishing house pvt. Ltd.

**Reference Books:**

1. Baker, Alan. A concise introduction to the theory of numbers. Cambridge University Press, Cambridge, 1984.

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2. Silverman, Joseph. A friendly introduction to number theory, 4th edition, Pearson Education, Inc., 2012.

## E Resources

### a) Concerned Website links

1. [https://www.youtube.com/watch?v=19SW3P\\_PRHQ](https://www.youtube.com/watch?v=19SW3P_PRHQ)
2. <https://www.youtube.com/watch?v=qvxKlbdRUyM>

### b) Concerned Journals/Magazines links

1. <https://www.journals.elsevier.com/journal-of-number-theory/most-downloaded-articles>
2. [https://www.journals.elsevier.com/journal-of-number-theory#:~:text=this%20field...-The%20Journal%20of%20Number%20Theory%20\(JNT\)%20features%20selected%20research%20articles,original%20research%20in%20this%20field.](https://www.journals.elsevier.com/journal-of-number-theory#:~:text=this%20field...-The%20Journal%20of%20Number%20Theory%20(JNT)%20features%20selected%20research%20articles,original%20research%20in%20this%20field.)

### c) NPTEL Videos

1. <https://nptel.ac.in/courses/111/103/111103020/>
2. <https://nptel.ac.in/courses/111/101/111101137/>

## Course Outcomes:

At the end of the course Student can able to

1. Understand linear Diophantine equation and Fundamental theorem of Arithmetic
2. Apply linear congruence and applications of congruence
3. Understand Arithmetic functions
4. Find primitive roots and determination of integers having primitive roots
5. Understand Quadratic Congruences, Quadratic Reciprocity Law and applications

## CO- PO Mapping

CO- PO, PSO Mapping												
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			1
CO2	2	2	2	3	2				2			1
CO3	2	2	2	3	2				2			1
CO4	3	2	2	3	3				2			2
CO5	2	2	2	3	3				2			2



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**(Autonomous)**

**Dept of Training and Placement**

**Quantitative Aptitude - I**

**III B. Tech I Sem MR18 Batch**

**(Common for All Branches)**

**Module – I**

**[8]**

**Quants: Percentages, Profit and Loss.**

- **Percentages-** Percentage Increase/Decrease; Results on Population; Results on Depreciation.
- **Profit & Loss-** Cost Price; Selling Price; Profit or Gain; Gain Percentage; Loss Percentage.

**Verbal: Articles, Para Jumbles**

- **Articles-** Types of articles, Countable nouns, Uncountable nouns, Usage of articles, Omission of articles.
- **Para Jumbles-** Para Jumbles, Types of Para Jumbles, Strategies to answer questions on Jumbled Paragraphs.

**Logical: Data Arrangements, Blood Relation**

- **Data Arrangements-** Linear Arrangement, Circular Arrangement, Multi-Dimensional Arrangement.
- **Blood Relations-** Classification of blood relations, Pointing a person, Equation related problems.

**Module – II**

**[6]**

**Quants: Interests**

- **Interests-** Types of interest; Simple interest; principle; Rate of interest; compound interest; interest is compounded Annually; interest is compounded Half-yearly; interest is compounded Quarterly; Rates are different for different years, say  $R_1\%$ ,  $R_2\%$ ,  $R_3\%$  for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> year respectively; Present worth of Rs. x due n years.

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### **Verbal: Sentence Completion, Prepositions**

- **Sentence Completion-** Formats of Question; Strategies to solve sentence completion questions- Proactive and reactive solving, Identifying clues- Signposts, Types of signposts, Root words, Sentence structure clues.
- **Prepositions-** Definition, Types of prepositions, Preposition of Place, Preposition of Time, Preposition of Direction, Compound Prepositions, Prepositional Phrases.

### **Logical: Coding and Decoding**

- **Coding and Decoding-**Number Series, Alphabet Series, Analogy, Odd Man Out, Visual Reasoning.

### **Module–III**

[6]

### **Quants: Ratio and Proportion, Averages**

- **Ratios & Proportion-**The ratio of two quantities a and b in the same units; Proportion; The equality of two ratios is called proportion; Fourth Proportional; Mean Proportional; Comparison of Ratios; Duplicate Ratios; Variations.
- **Averages-** Average Speed, Weighted average

### **Verbal: Vocabulary**

- **Vocabulary-**Etymology, Root Words, Prefixes and Suffixes; Synonyms and Antonyms, Tips to solve questions on Synonyms and Antonyms; Word Analogy, Patterns of questions on Word Analogy; Miscellaneous Vocabulary.

### **Logical: Data Interpretation and Data Sufficiency**

- **Data Interpretation-** Tables, Pie charts, Bar Graphs, Line graphs
- **Data Sufficiency-**Strategies to solve.

### **Module – IV**

[6]

### **Quants: Time and Work;**



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- **Time & Work-** Work from Days: Calculate the one-day work; Days from Work: Shortcut to calculate the work in given time;

### Verbal: Sentence Correction

- **Sentence Correction-** Subject-Verb Agreement; Modifiers; Parallelism; Pronoun-Antecedent Agreement; Verb Time Sequence; Comparisons; Determiners; Exercise Questions.

### Logical: Clocks and Calendars

- **Clocks:** Introduction, Derivation of angles, Angles between hands of the clock, Hands together, Hands at angular distance, Gain & Loss problems.
- **Calendars:** - Leap year-Non leap year, Odd days, Finding the day from date, Repeated years.

### Module - V:

[6]

### Quants: Mixtures and Alligations;

- **Alligation-** Mean Price; Rule of Alligation; a container contains x of liquid from which y units are taken out and replaced by water;

### Verbal: Reading Comprehension, Critical Reasoning

- **Reading Comprehension-** Speed reading strategies; Reading Comprehension - types of questions, tackling strategies; Critical Reasoning.

### Logical: Directions, Cubes, Syllogisms

- **Directions** -Introduction, Direction based questions, Shadow based problems.
- **Cubes-** Cube & cuboid concepts, 3-2-1-0 faced problems.
- **Syllogisms-** Statements and Conclusion, Syllogisms using Venn Diagrams.

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## Syllabus for MR18

### MALLA REDDY ENGINEERING COLLEGE (Autonomous)

#### Dept of Training and Placement

#### Quantitative Aptitude - II

#### III B. Tech II Sem MR18 Batch

#### (Common for All Branches)

#### Module – I

[8]

##### Quants: Number System (NS)

- **Number Systems**-Factors and Multiples: The H.C.F. of two or more than two numbers; Factorization Method Division Method; Finding the H.C.F. of more than two numbers; product of two numbers = Product of their H.C.F. and L.C.M.; Co-primes; H.C.F. and L.C.M. of Fractions: Comparison of Fractions.

##### Verbal: Articles, Para Jumbles

- **Articles**- Types of articles, Countable nouns, Uncountable nouns, Usage of articles, Omission of articles.
- **Para Jumbles**- Para Jumbles, Types of Para Jumbles, Strategies to answer questions on Jumbled Paragraphs.

##### Logical: Data Arrangements, Blood Relation

- **Data Arrangements**- Linear Arrangement, Circular Arrangement, Multi-Dimensional Arrangement.
- **Blood Relations**- Classification of blood relations, Pointing a person, Equation related problems.

#### Module – II

[6]

##### Quants: Time and Distance, Pipes

- **Time & Distance**-Km/hr to m/sec conversion; m/sec to km/hr conversion; man covers a certain distance at x km/hr and an equal distance at y km/hr

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### **Verbal: Sentence Completion, Prepositions**

- **Sentence Completion-** Formats of Question; Strategies to solve sentence completion questions- Proactive and reactive solving, Identifying clues- Signposts, Types of signposts, Root words, Sentence structure clues.
- **Prepositions-** Definition, Types of prepositions, Preposition of Place, Preposition of Time, Preposition of Direction, Compound Prepositions, Prepositional Phrases.

### **Logical: Coding and Decoding**

- **Coding and Decoding-**Number Series, Alphabet Series, Analogy, Odd Man Out, Visual Reasoning.

### **Module-III**

[6]

#### **Quants: Ages, Progression, Logarithms**

- **Ages, Progression-**;Arithmetic progression; Arithmetic mean; Geometric progression and mean
- **Logarithms-**Why logarithms: Properties of Logarithms: Laws of logarithm: Characteristic of logarithm:

### **Verbal: Vocabulary**

- **Vocabulary-**Etymology, Root Words, Prefixes and Suffixes; Synonyms and Antonyms, Tips to solve questions on Synonyms and Antonyms; Word Analogy, Patterns of questions on Word Analogy; Miscellaneous Vocabulary.

### **Logical: Data Interpretation and Data Sufficiency**

- **Data Interpretation-** Tables, Pie charts, Bar Graphs, Line graphs
- **Data Sufficiency-**Strategies to solve.

### **Module – IV**

[6]

#### **Quants: Permutations and Combinations, Probability**



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- **Permutations-Factorial Notation:** The different arrangements; Number of Permutations: number of all permutations of  $n$  things, taken all at a time;  $n$  subjects of which  $p_1$  are alike of one kind;  $p_2$  are alike of another kind;  $p_3$  are alike of third kind; Number of Combinations: The number of all combinations of  $n$  things, taken  $r$  at a time.

#### Verbal: Sentence Correction

- **Sentence Correction-** Subject-Verb Agreement; Modifiers; Parallelism; Pronoun-Antecedent Agreement; Verb Time Sequence; Comparisons; Determiners; Exercise Questions.

#### Logical: Clocks and Calendars

- **Clocks:** Introduction, Derivation of angles, Angles between hands of the clock, Hands together, Hands at angular distance, Gain & Loss problems.
- **Calendars:** - Leap year-Non leap year, Odd days, Finding the day from date, Repeated years.

#### Module - V:

[6]

#### Quants: Areas and Volumes (Mensuration)

- **Areas & Volumes-** Pythagoras Theorem Results on Quadrilaterals Perimeter; Area of a circle Circumference Length of an arc Area of a sector; Area of a triangle.

#### Verbal: Reading Comprehension, Critical Reasoning

- **Reading Comprehension-** Speed reading strategies; Reading Comprehension - types of questions, tackling strategies; Critical Reasoning.

#### Logical: Directions, Cubes, Syllogisms

- **Directions** -Introduction, Direction based questions, Shadow based problems.
- **Cubes-** Cube & cuboid concepts, 3-2-1-0 faced problems.
- **Syllogisms-** Statements and Conclusion, Syllogisms using Venn Diagrams.

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