



# Criterion-1: Curricular Aspects

## Key Indicator – 1.2: Academic Flexibility

### Metric: 1.2.1

## Programme: MSc Mathematics Education

<b>Syllabus</b>	<a href="https://www.du.ac.in/uploads/RevisedSyllabi1/Annexure-169.%20REVISED%20SYLLABUS%20OF%20M.SC.-FINAL-16.07.2019.pdf">https://www.du.ac.in/uploads/RevisedSyllabi1/Annexure-169.%20REVISED%20SYLLABUS%20OF%20M.SC.-FINAL-16.07.2019.pdf</a>
<b>Minutes of Executive Council</b>	<a href="https://www.du.ac.in/uploads/executive_council/30082019/21072019/Minutes%2020.07.2019%20as%20on%2001.08.2019.pdf">https://www.du.ac.in/uploads/executive_council/30082019/21072019/Minutes%2020.07.2019%20as%20on%2001.08.2019.pdf</a>
<b>Annexure of the Executive Council Minutes</b>	<a href="https://www.du.ac.in/uploads/executive_council/30082019/21072019/annexures/Annexure-169.%20REVISED%20SYLLABUS%20OF%20M.SC.-FINAL-16.07.2019.pdf">https://www.du.ac.in/uploads/executive_council/30082019/21072019/annexures/Annexure-169.%20REVISED%20SYLLABUS%20OF%20M.SC.-FINAL-16.07.2019.pdf</a>
<b>Highlighted Portions of Minutes and Syllabus where programme and courses were approved</b>	Attached

**MINUTES OF THE MEETING OF THE EXECUTIVE COUNCIL HELD ON SATURDAY, THE 20<sup>th</sup> JULY, 2019 at 11.00 A.M AND CONTINUED UPTO 11:00 P.M. ADJOURNED THEREAFTER AND RESUMED ON SUNDAY, THE 21<sup>st</sup> July 2019 at 11:30 A.M. IN THE COUNCIL ROOM, UNIVERSITY OF DELHI, DELHI-110007**

**No. 2**

**P R E S E N T**

- |     |                            |   |
|-----|----------------------------|---|
| 1.  | Prof. Yogesh Kumar Tyagi   | Vice-Chancellor - Chairman                    |
| 2.  | Prof. J.P. Khurana         | Director, South Campus                        |
| 3.  | Prof. C.S. Dubey           | Officiating Director, Campus of Open Learning |
| 4.  | Sh. T. S. Kripanidhi       | Treasurer                                     |
| 5.  | Prof. Neeta Sehgal         | Officiating Proctor                           |
| 6.  | Prof. Namita Ranganathan   |   |
| 7.  | Prof. Sathyabhama Das Biju |   |
| 8.  | Prof. Syed Ali Karim       |   |
| 9.  | Dr. Anula Maurya           |   |
| 10. | Dr. I. S. Bakshi           |   |
| 11. | Dr. InderJeet Singh        |   |
| 12. | Dr. J. L. Gupta            |   |
| 13. | Dr. Rajesh Kumar Jha       |   |
| 14. | Dr. V.S. Negi              |   |
| 15. | Sh. Rajesh Gogna           |   |
| 16. | Sh. Yogender Singh Mathur  |   |
| 17. | Ms. Indira Chandrasekhar   |   |

**SPECIAL INVITEES**

1. Prof. Kavita Sharma
2. Prof. M.K. Pandit
3. Prof. Pankaj Arora
4. Prof. Rajeev Gupta
5. Prof. Vinay Gupta
6. Dr. Payal Mago
7. Dr. Satish Kumar

Prof. Tarun Kumar Das - Registrar - Secretary

## WELCOME

**28/-** At the outset, the Council welcomed the following who have become members of the Executive Council:-

<b>STATUTE 5(1)(viii)(b)</b>	-	<b>Dean of the Faculties</b>
1. Prof. Syed Ali Karim	-	Dean, Faculty of Arts

## APPRECIATION

**29/-** The Council placed on record its deep sense of appreciation of the services rendered by the following as member of the Executive Council:-

<b>STATUTE 5(1)(viii)(b)</b>	-	<b>Dean of the Faculties</b>
1. Prof. Mohan	-	Dean, Faculty of Arts

**30/-** The Council expressed condolence on the sad demise of Smt. Sheila Dixit, former Chief Minister, Govt. of NCT of Delhi, and Prof. G.K. Das, Professor of English (Retd.) and former Director, South Delhi Campus, University of Delhi. The Council observed silence as a mark of respect for the departed souls.

**31/-** The Minutes of the meeting of the Executive Council held on 01-02.07.2019 (**Appendix-I**) were confirmed.  
(Six Members dissented on the date of eligibility for promotion of faculty members)

**32/-** The Action Taken Report on the decisions made by the Executive Council at its meeting held on 01-02.07.2019 was noted. (**Appendix-II**). Following matter was considered and approved:

**32-1/** Disciplinary Matter with respect to E.C. Resolution No. 21-VII dated 01-02.07.2019.

**32-2/** No matter was raised for discussion in Matter arising out of the Minutes of the Executive Council meeting held on 01-02.07.2019.

**33/-** The Executive Council approved the following recommendations made by the Academic Council at its meeting held on 15/16.07.2019. The Council further resolved that the consequential amendments to the relevant Ordinance of the University be made accordingly:

**33-1/** the recommendations of the Standing Committee on Academic Matters made at its meeting held on 20.08.2018 under the Chairmanship of Prof. J.P. Khurana, Pro-Vice-Chancellor, University of Delhi in respect of the following faculties regarding revision of courses under Choice Based Credit System (CBCS) be accepted.

Sr. No.	Faculty	Courses
1.	<b>Commerce &amp; Business Studies</b>	<p><b>Department of Commerce</b></p> <ol style="list-style-type: none"> <li>1. Master of Commerce (M.Com.) (<b>Annexure-1</b>)</li> <li>2. Master of Business Administration (International Business) MBA(IB) (<b>Annexure-2</b>)</li> <li>3. Master of Business Administration (Human Resource Development) MBA(HRD) (<b>Annexure-3</b>)</li> </ol> <p><b>Department of Financial Studies</b></p> <ol style="list-style-type: none"> <li>1. Change of the nomenclature of the course from MBA (Financial Management) to MBA (Finance) <b>and</b></li> <li>2. Master of Business Administration (Finance) (MBA) (Finance) (<b>Annexure-4</b>)</li> </ol>
2.	<b>Applied Social Sciences and Humanities</b>	<ol style="list-style-type: none"> <li>1. MBA (Business Economics) (<b>Annexure-5</b>)</li> <li>2. Conversion formula for the award of Diploma/ Advance Diploma/ Degree/ B. Voc. Course be modified in consultation with the Examination. (<b>Annexure-5A</b>)</li> <li>3. Introduction of new course curriculum of Bachelor of Business Administration (Entrepreneurship) (BBA (Entrepreneurship)). (<b>Annexure-6</b>)</li> </ol>
3.	<b>Music &amp; Fine Arts</b>	<p><b>Department of Music</b></p> <ol style="list-style-type: none"> <li>1. M.A. Hindustani Music (Vocal/Instrumental-Sitar/ Sarod/ Guitar/ Violin/ Santoor) (<b>Annexure-7</b>)</li> <li>2. M.A. Karnatak Music (Vocal/ Instrumental (Veena/ Violin) (<b>Annexure-8</b>)</li> <li>3. M.A. Percussion Music (Table/Pakhawaj) (<b>Annexure-9</b>)</li> <li>4. Scheme of Examination 2 year Diploma Course in Harmonium (Annual Mode). (<b>Annexure-10</b>)</li> <li>5. Revision of syllabus of subsidiary subject of BFA Applied Arts course. (<b>Annexure-11</b>)</li> </ol>

**33-2/** the recommendations of the Standing Committee on Academic Matters made at its meeting held on 24.08.2018 under the Chairmanship of Prof. J.P. Khurana, Pro-Vice-Chancellor, University of Delhi in respect of the following faculties regarding revision of courses under Choice Based Credit System (CBCS) be accepted.

Sr. No.	Faculty	Courses
1.	<b>Science</b>	<p><b>Department of Anthropology</b></p> <ol style="list-style-type: none"> <li>1. M.Sc. Anthropology (<b>Annexure-12</b>)</li> <li>2. M.Sc. Forensic Science (<b>Annexure-13</b>)</li> </ol>
		<p><b>Dr. B.R. Ambedkar Centre for Biomedical Research</b></p> <ol style="list-style-type: none"> <li>1. M.Sc. Biomedical Science Course (<b>Annexure-14</b>)</li> </ol>
		<p><b>Department of Botany</b></p> <ol style="list-style-type: none"> <li>1. M.Sc. Botany (<b>Annexure-15</b>)</li> </ol>
		<p><b>Department of Environmental Studies</b></p> <ol style="list-style-type: none"> <li>1. M.A./M.Sc. Environmental Studies (<b>Annexure-16</b>)</li> </ol>
		<p><b>Department of Geology</b></p> <ol style="list-style-type: none"> <li>1. M.Sc. Geology (<b>Annexure-17</b>)</li> </ol>
		<p><b>Department of Physics &amp; Astrophysics</b></p> <ol style="list-style-type: none"> <li>1. M.Sc. Physics (<b>Annexure-18</b>)</li> </ol>

		<p><b><u>Department of Zoology</u></b> 1. M.Sc. Zoology (<b>Annexure-19</b>)</p>
		<p><b><u>Department of Home Science</u></b> 1. M.Sc. Food and Nutrition (<b>Annexure-20</b>) 2. M.Sc. Human Development and Childhood Studies (<b>Annexure-21</b>) 3. M.Sc. Development Communication and Extension (<b>Annexure-22</b>) 4. M.Sc. Resource Management and Design Application (<b>Annexure-23</b>) 5. M.Sc. Fabric and Apparel Science (<b>Annexure-24</b>) 6. Post-Graduate Diploma in Dietetics and Public Health Nutrition – PGDDPHN (<b>Annexure-25</b>) 7. Post-Graduate Diploma in Health and Social Gerontology – PGDHSG (<b>Annexure-26</b>)</p>
		<p><b><u>Pt. Deendayal Upadhyaya National Institute for Persons with Physical Disabilities (Divyangjan)</u></b> 1. Master in Prosthetics and Orthotics (MPO) two year duration (Annual) (<b>Annexure-27</b>) 2. Bachelor in Prosthetics and Orthotics (BPO) 4½years duration (Annual) (<b>Annexure-28</b>) 3. Introduction of new course curriculum of Part Time Bachelor in Prosthetics and Orthotics condensed course (only for three batches) two years duration (Annual) excluding internship. (<b>Annexure-29</b>)</p>
2.	<b>Inter-disciplinary &amp; Applied Sciences</b>	<p><b><u>Department of Bio-Chemistry</u></b> 1. M.Sc. Biochemistry (<b>Annexure-30</b>)</p>
		<p><b><u>Department of Electronics</u></b> 1. Master of Science (Electronics). (<b>Annexure-31</b>)</p>
		<p><b><u>Department of Genetics</u></b> 1. Master of Science (Genetics) (<b>Annexure-32</b>)</p>
		<p><b><u>Institute of Informatics &amp; Communication (IIC)</u></b> 1. Master of Science in Informatics (M.Sc. Informatics) (<b>Annexure-33</b>)</p>
		<p><b><u>Department of Plant Molecular Biology</u></b> 1. Master of Science in Plant Molecular Biology and Biotechnology (PMBB) course. (<b>Annexure-34</b>)</p>
		<p><b><u>Department of Microbiology</u></b> 1. Master of Science in Microbiology. (<b>Annexure-35</b>)</p>
		<p><b><u>Department of Biophysics</u></b> 1. M.Sc. Biophysics (<b>Annexure-36</b>)</p>
3.	<b>Mathematical Sciences</b>	<p><b><u>Department of Mathematics</u></b> 1. M.A./ M.Sc. Mathematics (<b>Annexure-37</b>)</p>
		<p><b><u>Department of Operational Research</u></b> 1. Master of Operational Research course (MOR) (<b>Annexure-38</b>)</p>
		<p><b><u>Department of Computer Science</u></b> 1. Introduction of new elective course MCS-210 (Deep</p>

		Learning) ( <b>Annexure-39</b> ) and MCA-526 (Deep Learning) ( <b>Annexure-40</b> ) in M.Sc. Computer Science, MCA courses 2. Master of Computer Applications ( <b>Annexure-41</b> ) 3. M.Sc. Computer Science ( <b>Annexure-42</b> )
		<b><u>Department of Statistics</u></b> 1. M.A./M.Sc. Statistics ( <b>Annexure-43</b> )

**33-3/** the recommendations of the Standing Committee on Academic Matters made at its meeting held on 28.08.2018 under the Chairmanship of Prof. J.P. Khurana, Pro-Vice-Chancellor, University of Delhi in respect of the following faculties regarding revision of courses under Choice Based Credit System (CBCS) be accepted.

Sr. No.	Faculty	Courses
1.	Arts	<b><u>Department of English</u></b> 1. M.A. English ( <b>Annexure-44</b> )
		<b><u>Department of Persian</u></b> 1. M.A. Persian ( <b>Annexure-45</b> )
		<b><u>Department of Hindi</u></b> 1. M.A. Hindi ( <b>Annexure-46</b> )
		<b><u>Department of Psychology</u></b> 1. M.A. Psychology ( <b>Annexure-47</b> ) 2. M.A. Applied Psychology ( <b>Annexure-48</b> )
		<b><u>Department of MIL &amp; Literary Studies</u></b> 1. M.A. in Tamil ( <b>Annexure-49</b> ) 2. M.A. in Bengali ( <b>Annexure-50</b> ) 3. M.A. in Comparative Indian Literature ( <b>Annexure-51</b> )
		<b><u>Department of Philosophy</u></b> 1. M.A. Philosophy ( <b>Annexure-52</b> )
		<b><u>Department of Germanic &amp; Romance Studies</u></b> 1. M.A. in Italian Studies ( <b>Annexure-53</b> ) 2. M.A. in French Studies ( <b>Annexure-54</b> ) 3. M.A. in German Studies ( <b>Annexure-55</b> ) 4. M.A. in Hispanic Studies ( <b>Annexure-56</b> )
		<b><u>Department of Slavonic &amp; Finno Ugrian Studies</u></b> 1. M.A. Russian ( <b>Annexure-57</b> )
		<b><u>Department of Library &amp; Information Science</u></b> 1. Post-Graduate courses B.LISc. and M.LISc. ( <b>Annexure-58</b> )
		<b><u>Department of Urdu</u></b> 1. M.A. Urdu ( <b>Annexure-59</b> )
		<b><u>Department of Arabic</u></b> 1. M.A. Arabic ( <b>Annexure-60</b> )
		<b><u>Department of Sanskrit</u></b> 1. M.A. Sanskrit ( <b>Annexure-61</b> )
		<b><u>Department of Buddhist Studies</u></b> 1. M.A. Buddhist Studies ( <b>Annexure-62</b> )
2.	Social Science	<b><u>Department of Adult Continuing Education &amp; Extension</u></b> 1. M.A. Lifelong Learning & Extension ( <b>Annexure-63</b> )

		<p><b><u>Department of East Asian Studies</u></b></p> <p>1. M.A. East Asian Studies (<b>Annexure-64</b>)</p> <p>2. Passing criteria of part time Certificate/ Diploma/ Advance Diploma course: (<b>Annexure-65</b>)</p> <p>a. Certificate Course in Chinese Language (part-time) (CP-1)</p> <p>b. Certificate Course in Japanese Language (part-time) (JP-1)</p> <p>c. Certificate Course in Korean Language (part-time) (KP-1)</p> <p>d. Diploma Course in Chinese Language (part-time) (CP-2)</p> <p>e. Diploma Course in Japanese Language (part-time) (JP-2)</p> <p>f. Diploma Course in Korean Language (part-time) (KP-2)</p> <p>g. Advanced Diploma Course in Chinese Language (part-time) (CP-3)</p> <p>h. Advanced Diploma Course in Japanese Language (part-time) (JP-3)</p> <p>i. Advanced Diploma Course in Korean Language (part-time) (KP-3)</p>
		<p><b><u>Department of Geography</u></b></p> <p>1. M.A. Geography (<b>Annexure-66</b>)</p>
		<p><b><u>Department of History</u></b></p> <p>1. M.A. History (<b>Annexure-67</b>)</p>
		<p><b><u>Department of Political Science</u></b></p> <p>1. M.A. Political Science (<b>Annexure-69</b>)</p>
		<p><b><u>Department of Social Work</u></b></p> <p>1. M.A. Social Work (<b>Annexure-70</b>)</p>
		<p><b><u>Department of Sociology</u></b></p> <p>1. M.A. Sociology (<b>Annexure-71</b>)</p>
		<p><b><u>Department of Economics</u></b></p> <p>1. Introduction of syllabus of Basic Computational Techniques for Data Analysis paper of Department of Economics in B.A. Programme (CBCS) SEC IV (6<sup>th</sup> Semester). (<b>Annexure-72</b>)</p>
3.	Law	1. Bachelor of Law (LL.B.) ( <b>Annexure-73</b> )

**33-4/** the recommendations of the Standing Committee on Academic Matters made at its meeting held on 11<sup>th</sup> July, 2019 and 14<sup>th</sup> July, 2019 under the Chairmanship of Prof. J.P. Khurana, Pro-Vice-Chancellor, University of Delhi in respect of the following faculties/ Centre regarding revision/introduction of courses under Choice Based Credit System (CBCS) be accepted.

Sr. No.	Faculty	Courses
1.	Mathematical Sciences	<p><b><u>Department of Mathematical Sciences</u></b></p> <p>1. B.Sc. (Hons.) Mathematics (<b>Annexure-74</b>)</p> <p>2. B.Sc. (Programme) Physical Sciences/Mathematical Sciences. (<b>Annexure-75</b>)</p> <p>3. B.A. (Programme) Mathematics based papers. (<b>Annexure-76</b>)</p> <p>4. B.Sc. (Programme) Analytical Chemistry. (<b>Annexure-77</b>)</p>

		<p>5. Generic Elective (GE) for Honours Courses. (<b>Annexure-78</b>)</p> <p>6. Generic Elective (GE) for B.A./ B.Com. Courses. (<b>Annexure-79</b>)</p> <p><b>Department of Statistics</b></p> <p>1. B.Sc. (Hons.) Statistics. (<b>Annexure-80</b>)</p> <p>2. B.A. (Programme) Statistics based papers. (<b>Annexure-81</b>)</p> <p>3. B.Sc. (Programme) Mathematical Sciences. (<b>Annexure-82</b>)</p> <p><b>Department of Computer Science</b></p> <p>1. B.Sc. (Hons.) Computer Science Programme. (<b>Annexure-83</b>)</p> <p>2. B.Sc. Programme Physical/ Mathematical Sciences. (<b>Annexure-84</b>)</p> <p>3. B.A. (Programme) Discipline Course in Computer Application. (<b>Annexure-85</b>)</p> <p>4. General Electives for Hons./ Non-Hons. Programs. (<b>Annexure-86</b>)</p> <p>5. MCA – Deep Learning MCA-410. (<b>Annexure-87</b>)</p> <p>6. M.Sc. – Deep Learning MCS-210. (<b>Annexure-88</b>)</p> <p><b>Department of Operational Research</b></p> <p>1. O.R. papers for B.Sc. Mathematical Sciences. (<b>Annexure-89</b>)</p> <p>2. O.R. papers for B.A. Programme. (<b>Annexure-90</b>)</p> <p>3. General Elective courses for B.A. (Hons.)/ B.Com. (Hons.)/B.Sc. (Hons.). (<b>Annexure-91</b>)</p>
2	<b>Faculty of Commerce &amp; Business Studies</b>	<p><b>Department of Commerce</b></p> <p>1. B.Com. (Hons.) (<b>Annexure-92</b>)</p> <p>2. B.Com. (Pass). (<b>Annexure-93</b>)</p> <p>3. B.A. (Programme) Commerce based papers. (<b>Annexure-94</b>)</p>
3.	<b>Faculty of Science</b>	<p>1. B.Sc. (Hons.) Polymer Science. (<b>Annexure-95</b>)</p> <p>2. B.Sc. (Hons.) Biological Science. (<b>Annexure-96</b>)</p> <p><b>Department of Botany</b></p> <p>1. B.Sc. (Hons.) Botany. (<b>Annexure-97</b>)</p> <p>2. B.Sc. Programme Applied Life Sciences with Agrochemicals and Pest Management (Botany Component) . (<b>Annexure-98</b>)</p> <p>3. B.Sc. Programme in Life Sciences (Botany Component). (<b>Annexure-99</b>)</p> <p><b>Department of Anthropology</b></p> <p>1. B.Sc. (Hons.) Anthropology. (<b>Annexure-100</b>)</p> <p><b>Department of Environmental Studies</b></p> <p>1. Six month Ability Enhancement compulsory course (AECC-I), Environmental Studies. (<b>Annexure-101</b>)</p> <p><b>Department of Home Science</b></p> <p>1. B.Sc. (Hons.) Home Science. (<b>Annexure-102</b>)</p> <p>2. B.Sc. (Hons.) Food Technology. (<b>Annexure-103</b>)</p> <p>3. B.Sc. (Prog.) Home Science. (<b>Annexure-104</b>)</p> <p>4. B.A. Programme Home Science based papers:</p> <p>(a) Nutrition Health Education. (<b>Annexure-105</b>)</p> <p>(b) Food Technology. (<b>Annexure-106</b>)</p> <p>(c) Apparel Design &amp; Construction. (<b>Annexure-107</b>)</p> <p>(d) Human Development &amp; Family Empowerment. (<b>Annexure-108</b>)</p> <p><b>Department of Zoology</b></p> <p>1. B.Sc. (Hons.) Zoology. (<b>Annexure-109</b>)</p>

		<p>2. B.Sc. (Programme) Life Sciences. (<b>Annexure-110</b>)</p> <p>3. B.Sc. (Programme) Applied Life Science with Agrochemicals &amp; Pest Management. (<b>Annexure-111</b>)</p> <p><b>Ambedkar Centre for Biomedical Research</b></p> <p>1. B.Sc. (Hons.) Biomedical Science. (<b>Annexure-112</b>)</p> <p><b>Department of Geology</b></p> <p>1. B.Sc. (Hons.) Geology. (<b>Annexure-113</b>)</p> <p><b>Department of Physics &amp; Astrophysics</b></p> <p>1. B.Sc. (Hons.) Physics. (<b>Annexure-114</b>)</p> <p>2. B.Sc. Physical Sciences (Discipline Physics). (<b>Annexure-115</b>)</p> <p>3. B.Sc. Physical Sciences (Discipline Electronics). (<b>Annexure-116</b>)</p>
4.	<b>Faculty of Music &amp; Fine Arts</b>	<p><b>Department of Music</b></p> <p>1. B.A. (Hons.) Hindustani Music (Vocal/ Instrumental). (<b>Annexure-117</b>)</p> <p>2. B.A. (Hons.) Karnatak Music (Vocal/ Instrumental). (<b>Annexure-118</b>)</p> <p>3. B.A. (Hons.) Hindustani Music – Percussion (Tabla/ Pakhawaj). (<b>Annexure-119</b>)</p> <p>4. B.A. (Prog.) Hindustani Music based paper. (<b>Annexure-120</b>)</p> <p>5. Generic Elective (GE) – Hindustani Music for other Hons. Courses. (<b>Annexure-121</b>)</p>
5.	<b>Inter-disciplinary &amp; Applied Sciences</b>	<p><b>Department of Biochemistry</b></p> <p>1. B.Sc. (Hons.) Biochemistry. (<b>Annexure-122</b>)</p> <p><b>Department of Microbiology</b></p> <p>1. B.Sc. (Hons.) Microbiology. (<b>Annexure-123</b>)</p> <p><b>Department of Electronic Science</b></p> <p>1. B.Sc. (Hons.) Electronic Science. (<b>Annexure-124</b>)</p> <p>2. B.Sc. (Hons.) Instrumentation. (<b>Annexure-125</b>)</p> <p>3. Change of scheme of examination for the curriculum in M.Tech.(Microwave Electronics).(<b>Annexure-126</b>)</p> <p><b>Department of Physical Education &amp; Sports Sciences</b></p> <p>1. B.Sc. (P.E., H.E.&amp; S.) Programme. (<b>Annexure-127</b>)</p>
6.	<b>Applied Sciences &amp; Social &amp; Humanities</b>	<p>1. B.A. (Hons.) Multi Media and Mass Communication. (<b>Annexure-128</b>)</p> <p>2. Bachelor of Management Studies (BMS). (<b>Annexure-128A</b>)</p> <p>3. Bachelor of Business Administration (Financial Investment Analysis) BBA(FIA). (<b>Annexure-129</b>)</p> <p>4. Bachelor of Business Economics. (<b>Annexure-130</b>)</p> <p>5. B.Voc. (Retail and Logistics Management).* (<b>Annexure-131</b>)</p> <p>6. B.Voc. ( E-Taxation and E-Accounting).* (<b>Annexure-132</b>)</p> <p>7. B.Voc. (Applied Computer Sciences).* (<b>Annexure-133</b>)</p> <p>8. B.Voc. (Forensic Science Techniques).* (<b>Annexure-134</b>)</p> <p>9. B.Voc. (Communication and Mass Media Production).* (<b>Annexure-135</b>)</p> <p>10. B.Voc. (Multimedia, e-Learning and m-Learning).* (<b>Annexure-136</b>)</p> <p>* <i>Ref.: A.C. Resolution No. 11 dated 2/16 January, 2019.</i></p>
7.	<b>Arts</b>	<p><b>Department of Arabic</b></p> <p>1. B.A. (Hons.) Arabic. (<b>Annexure-137</b>)</p>

		2. B.A. (Programme) Arabic. ( <b>Annexure-138</b> ) <b>Department of Buddhist Studies</b> 1. B.A. (Prog.) Buddhist Studies. ( <b>Annexure-139</b> )
		<b>Department of Germanic &amp; Romance Studies</b> 1. B.A. (Hons.) French. ( <b>Annexure-140</b> ) 2. B.A. (Hons.) German. ( <b>Annexure-141</b> ) 3. B.A. (Hons.) Italian. ( <b>Annexure-142</b> ) 4. B.A. (Hons.) Spanish. ( <b>Annexure-143</b> ) 5. B.A. (Prog.) French. ( <b>Annexure-144</b> ) 6. B.A. (Prog.) German. ( <b>Annexure-145</b> ) 7. B.A. (Prog.) Spanish. ( <b>Annexure-146</b> )
		<b>Department of Linguistics</b> 1. B.A. Programme Linguistics. ( <b>Annexure-147</b> ) 2. M.A. Linguistics. ( <b>Annexure-148</b> )
		<b>Department of Modern Indian Languages and Literary Studies</b> 1. B.A. (Hons.) Bengali. ( <b>Annexure-149</b> ) 2. UG Course Bengali. ( <b>Annexure-150</b> ) 3. UG Course Sindhi. ( <b>Annexure-151</b> ) 4. UG Course Tamil. ( <b>Annexure-152</b> ) 5. UG Course Telugu. ( <b>Annexure-153</b> ) 6. MIL core Courses (Assamese, Gujrati, Kannada, Malayalam, Manipuri, Marathi, Odia). ( <b>Annexure-154</b> )
		<b>Department of Persian</b> 1. B.A. (Hons.) Persian. ( <b>Annexure-155</b> ) 2. B.A. Programme Persian. ( <b>Annexure-156</b> )
		<b>Department of Philosophy</b> 1. B.A. (Hons.) Philosophy. ( <b>Annexure-157</b> ) 2. B.A. Programme Philosophy. ( <b>Annexure-158</b> )
		<b>Department of Psychology</b> 1. B.A. (Hons.) Psychology. ( <b>Annexure-159</b> ) 2. B.A. (Hons.) Applied Psychology. ( <b>Annexure-160</b> )
		<b>Department of Punjabi</b> 1. B.A. (Hons.) Punjabi. ( <b>Annexure-161</b> ) 2. And Other Honours Courses. ( <b>Annexure-162</b> )
		<b>Department of Sanskrit</b> 1. B.A. (Hons.) Sanskrit. ( <b>Annexure-163</b> ) 2. Undergraduate Course for Sanskrit. ( <b>Annexure-164</b> )
		<b>Department of Urdu</b> 1. B.A. (Hons.) Urdu. ( <b>Annexure-165</b> ) 2. B.A. (Prog.)/B.Com. (Prog.) Urdu. ( <b>Annexure-166</b> )
8.	<b>Cluster Innovation Centre</b>	<b>Cluster Innovation Centre</b> 1. B. Tech. (Information Technology & Mathematical Innovations). ( <b>Annexure-167</b> ) 2. B.A. (Hons.) (Humanities & Social Sciences). ( <b>Annexure-168</b> ) 3. M.Sc. (Mathematics Education) ( <b>Annexure-169</b> )
9.	<b>Social Sciences</b>	<b>Department of Economics</b> 1. B.A. (Hons.) Economics. ( <b>Annexure-170</b> ) 2. B.A. (Prog.) Economics. ( <b>Annexure-171</b> ) 3. B.Com. (Prog.) General Elective Course. ( <b>Annexure-172</b> ) 4. M.A. Economics ( <b>Annexure-173</b> )

		<p><b><u>Department of Social Work</u></b> 1. B.A. (Hons.) Social Work. (<b>Annexure-174</b>)</p> <p><b><u>Department of Adult Continuing Education &amp; Extension</u></b> 1. Generic Elective Courses for B.A. (Hons.) Journalism. (<b>Annexure-175</b>)</p> <p><b><u>College of Vocational Studies</u></b> 1. B.A. (Vocational Studies) Human Resource Management (<b>Annexure-176</b>) 2. B.A. (Vocational Studies) Management and Marketing of Insurance. (<b>Annexure-177</b>) 3. B.A. (Vocational Studies) Marketing Management and Retail Business. (<b>Annexure-178</b>) 4. B.A. (Vocational Studies) Material Management. (<b>Annexure-179</b>) 5. B.A. (Vocational Studies) Office Management &amp; Secretarial Practice. (<b>Annexure-180</b>) 6. B.A. (Vocational Studies) Small and Medium Enterprises. (<b>Annexure-181</b>) 7. B.A. (Vocational Studies) Tourism Management. (<b>Annexure-182</b>)</p>
10.	<b>Education</b>	1. B.A. (Prog.) Education. ( <b>Annexure-183</b> )
11.	<b>Management Studies</b>	1. Master of Business Administration (MBA) (Full Time) ( <b>Annexure-184</b> ) 2. Master of Business Administration (Health Care Administration) ( <b>Annexure-185</b> ) 3. Master of Business Administration (Executive) ( <b>Annexure-186</b> )
12.	<b>Medical Sciences</b>	1. Change of nomenclature of M.Ch. Plastic Surgery to M.Ch. (Plastic & Reconstructive Surgery) ( <b>Annexure-187</b> ) 2. Change of nomenclature of MD (Radio-therapy) to MD (Radiation Oncology) ( <b>Annexure-188</b> ) 3. Amendment in the MDS Ordinance. ( <b>Annexure-189</b> )

**33-5/** the recommendations of the Standing Committee on Academic Matters made at its meeting held on 20.08.2018, 24.08.2018, 28.08.2018 and 11.07.2019 under the Chairmanship of Prof. J.P. Khurana, the Pro-Vice-Chancellor, University of Delhi in respect of the following faculties regarding revision of courses under Choice Based Credit System (CBCS) be accepted:

Sr. No	Faculty	Courses
1.	Arts	<p><b><u>Department of Punjabi</u></b> 1. M.A. Punjabi. (<b>Annexure-191</b>)</p> <p><b><u>Department of Hindi</u></b> 1. B.A. (Prog.) Hindi. (<b>Annexure-192</b>) 2. B.Com. (Prog.) Hindi. (<b>Annexure-193</b>) 3. B.A. (Prog.) Prayojanmoolak Hindi. (<b>Annexure-194</b>) 4. B.A. (Hons.) Hindi. (<b>Annexure-195</b>) 5. B.A. (Hons.) Hindi Patrakarita evam Jansanchar. (<b>Annexure-196</b>)</p>
2.	Law	1. LL.M. (2year/3year) ( <b>Annexure-197</b> )

<b>3.</b>	<b>Science</b>	<u><b>Department of Chemistry</b></u> 1. M.Sc. Chemistry ( <b>Annexure-198</b> ) 2. B.Sc. (Programme) Life Science. ( <b>Annexure-200</b> ) 3. B.Sc. (Programme) Physical Science. ( <b>Annexure-201</b> ) 4. B.Sc. Applied Life Sciences with Agrochemicals and Pest Management. ( <b>Annexure-202</b> ) 5. B.Sc. Analytical Chemistry. ( <b>Annexure-203</b> ) 6. B.Sc. Industrial Chemistry. ( <b>Annexure-204</b> )
<b>4.</b>	<b>Social Sciences</b>	<u><b>Department of Geography</b></u> 1. B.A. (Hons.) Geography and B.A./B.Sc. (Prog.) Geography. ( <b>Annexure-205</b> )

(The above Resolution No. 33-1, 33-2, 33-3, 33-4 and 33-5 have been minuted separately also on 21.07.2019).

**33-6/** The Council accepted the recommendations of Academic Council to constitute an Oversight Committee for addressing matters related to revision of Courses, if any, and other related matters.

(Four Members dissented)

**33-7/** Resolved that B.Sc. (Hons.) Chemistry syllabi be approved, except Skill Enhancement Course (SEC) titled “Reactions, Reagents and Chemical Process” be referred back to the Department of Chemistry for further consideration by the Committee of Courses and Faculty of Science and the revised version of the SEC be then submitted to the ‘Oversight Committee’ for further necessary action.

**33-8/** Syllabi of Undergraduate Courses of Department of English, Department of Sociology, Department of History and Department of Political Science, after incorporating suggestions of the members of the Academic Council by the respective Head of the Departments, were placed on the table. After due deliberations, it was resolved that these syllabi be referred back to the respective Departments for further consideration by the Committee of Courses and respective faculties and the revised version of the syllabi be then submitted to the ‘Oversight Committee’ for further necessary action.

(Two Members dissented)

**33-9/** Resolved that NCTE letter No. NCTE-Reg/011/59/2019-US(Regulation)HQ/79745 dated 20.06.2019 from the Under Secretary, NCTE, Delhi containing NCTE Regulation 2014 and NCTE Amendments Regulations 2017, be accepted (**Annexure-206**).

**33-10/** Resolved that proposed Modifications in the Ordinance IX (8) regarding Post-Graduate Courses (M.A./ M.Sc./ M.Com.) governed under the scheme of Examinations of the Choice Based Credit System (CBCS) recommended by the Committee under Co-Chairperson Prof. Kavita Sharma constituted vide University Notification No. Acad.I/Admissions/2018/456 dated 22<sup>nd</sup> February, 2018 be accepted. It was further resolved that consequential amendments to the relevant Ordinances of the University be made accordingly. (**Annexure-207**)

**33-11/** Resolved that the revised curriculum of the Under-graduate and Post-graduate courses shall also be applicable for School of Open Learning and Non-Collegiate Women Education Board (NCWEB) w.e.f. academic session 2019-2020. Accordingly, the examination scheme for Under-graduate and Post-graduate shall also be applicable to both School of Open Learning and Non-Collegiate Women Education Board. Director, COL, and Chairman, NCWEB, in consultation with Dean (Examination) will work out the modalities about the conduct of examinations in semester mode and present a proposal before the Executive Council.

**34/-** The Executive Council considered the panel of names duly approved by the Hon'ble Dy. Chief Minister, Govt. of NCT of Delhi for nomination to the Governing Bodies of 28 Govt. of NCT of Delhi Sponsored Colleges of the University of Delhi. The panel received vide letter no. DHE-33(2)/G.B./28/Colleges/2019/2738 dated 28.06.2019 and DHE-33(2)/G.B./28/Colleges/2019/3185-88 dated 18.07.2019 Govt. of NCT of Delhi are placed at **Appendix-III**.

Members noted several discrepancies in the panel of names recommended by the Govt. of NCT (from their list), which are not as per norms and also lacked some details essential for consideration by the Executive Council. It was thus resolved to constitute a Committee to review the panel of names and make appropriate suggestions for communication to the Govt. of NCT to revise the list at the earliest.

**35/-** Resolved that the following panel of persons for election of the Treasurer of the University under provision of Statute (11)(J) be approved.

1. Dr. Subhash Chandra Pandey
2. Shri P.K. Mishra
3. Shri K. Satheesh Babu

(Copies of the CV/Resume are enclosed as Appendix-IV)

**36/-** The following decision/action taken by the Vice-Chancellor in exercise of his powers/delegated powers vest upon him other than emergency powers in the following matters were reported, recorded and confirmed:

1. Accord of approval on 17.06.2019 to the constitution of the Editorial Board consisting of the following to prepare the 96<sup>th</sup> Annual Report, (period from 1<sup>st</sup> April 2018 to 31<sup>st</sup> March 2019) of the University.
  1. Prof. Pami Dua, Dean Academic Activities & Projects - Chairperson
  2. Prof. Tarun Kumar Das, Registrar
  3. Dr. Payal Mago, Joint Dean Colleges
  4. Prof. Yogendra Singh, Dean Research, Life Sciences
  5. Prof. T. R. Seshadri, Dean Research, Physical & Mathematical Sciences
  6. Prof. Suman Kundu, Department of Biochemistry
  7. Prof. Reetesh Kumar Singh, Dean, Faculty of Commerce
  8. Prof. Sunita Singh Sengupta, Dean, Faculty of Management Studies
  9. Prof. Neera Agnimitra, Head, Department of Social Work
  10. Prof. Arun Jaganath, Department of Botany
  11. Prof. Sanjay Kapoor, Department of Plant Molecular Biology
  12. Prof. Vandana Roy, Dean, Faculty of Medical Sciences

13. Prof. Ajay Kumar, Department of Mathematics
14. Prof. Nandita Babu, Department of Psychology
15. Prof. Shormishtha Panja, Department of English
16. Dr. Mukesh Mehlawat, Department of Operational Research
17. Dr. Asani Bhaduri, Cluster Innovation Centre
18. Dr. K. Ratnabali, Faculty of Law
19. Capt. Parminder Sehgal, NSS Coordinator
20. Dr. Uma Chaudhry, Bhaskaracharya College of Applied Science
21. Dr. Surinder Kaur, SGTB Khalsa College
22. Dr. Renu Baweja, Shivaji College
23. Dr. Sudhir Sharma, Joint Registrar, Council

2. Accord of approval on 06.07.2019 to the extension of deputation to Dr. Sugata Bag as Visiting Professor of Economics Chair at University of Colombo, Colombo, Sri Lanka for a period of six months i.e. till 13.01.2020.

**37/- Ref.: E.C. Resolution No. 4 (12) dated 28.05.2015**

Resolved that the receipt of letter No. 4-11/2017-CU-II, Government of India, Ministry of Human Resource Development, Department of Higher Education dated 26<sup>th</sup> June, 2019 received from Sh. P.K. Singh, Under Secretary to the Government of India regarding amendment to Statute 9-B of the Statutes of the University related to the merger of Department of Business Economics and Department of Financial Studies into a single department named as “*Department of Finance and Business Economics*” be reported and recorded. **(Copy of letter is placed at Appendix-V)**

**38/- The action taken by the Vice-Chancellor in appointing/ re-appointing/ nominating/ re-nominating, in the following matters were reported, recorded and confirmed:-**

**38-1/-** In appointing the Teacher Representatives on the Governing Bodies of the colleges for a period of one year as per provisions of Ordinance-XVIII of the University. The details are placed at **Appendix-VI**.

**38-2/-** In appointing/Re-appointing/Extension of term of appointment in respect of Chairman/Chairperson/E.C. Nominee/Special Invitee/Ex-Officio Member/Members of the Governing Bodies of University Maintained Institution/Colleges.

**For Governing Body of Dyal Singh College for a period of one year w.e.f. 04.07.2019:**

1. Mr. Rajiv Nayan as Chairman
2. Dr. Varun Veer as Member
3. Prof. Shobha Sinha, as Member

**38-3/-** University Representatives on the Governing Body of the various Colleges for a period of one year as per details placed at **Appendix-VII**.

**Any other item with the permission of Chair.**

**39/-** Serious concern was expressed about the status of the facilities and availability of infrastructure in a few of the Trust Maintained Colleges, and it was pointed out that some of these Trusts do not regularly contribute their mandatory 5% share towards the budget of the college concerned. It is, thus, imperative that any trust that has failed to contribute its share, the process of getting 100% grant-in-aid from the UGC and converting that Trust Maintained College into a University maintained institution may be initiated.

The meeting ended with a vote of thanks to the Chair.

**Sd/-**  
**(Prof. Tarun Kumar Das)**  
Registrar – Secretary

**Sd/-**  
**(Prof. Yogesh Kumar Tyagi)**  
Vice-Chancellor – Chairman

# **UNIVERSITY OF DELHI**

## **MASTER OF SCIENCE**

**(Mathematics Education)**

**Revision Under CBCS scheme**

**Scheme of Study and Examination**

**(2019)**



**Cluster Innovation Centre**

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## **About Cluster Innovation Centre**

Inspired by National Innovation Council (GoI) initiatives, in September 2011, University of Delhi started the first academic Cluster Innovation Centre in India. Cluster Innovation Centre, or CIC as it is popularly known, has been designed to seek and derive innovations from industrial clusters, village clusters, slum cluster and educational clusters. It is an endeavour to harness the passion and dedication of bright young minds with some of the major challenges of India and civil society. We strive to stream relevant ideas and programmes stemming from the above mandate into its learning and research programmes. The hallmark of the CIC is “out of the box” thinking and action with hands on” applications through a trans-disciplinary route. The CIC has pioneered the concept of a Meta College as well as a Meta University and runs highly innovative state of art learning and research programmes. The centre also has an active Design Innovation Centre, funded by MHRD which provides support to translate innovative ideas into practice.

### **Aims**

- To provide a platform for the University and its partners to forge mutually beneficial linkages to initiate and assist innovation activities and act as a catalyst and facilitator.
- To create an ecosystem that connects and facilitates various stakeholders on all aspects of the innovation process including training and support
- To promote innovations, channel various incentives that benefit the cluster and act as an incubating body managing the growth of innovation in the ecosystem.

### **Broad Objectives**

- Connecting research with application for the benefit of society.
- Support application oriented research to solve real world problems.
- Focus on developing affordable innovations that can benefit a large number of people and at the same time commercially viable and sustainable.

### **About Meta University Program**

The first Meta University based program, Master of Mathematics Education (renamed as M.Sc. Mathematics Education as per UGC guidelines) was started at Cluster Innovation Centre and AJK Mass Communication and Research Centre, JMI, by joint collaboration between University of Delhi and Jamia Millia Islamia in January 2013.

Under the concept of Meta University, M.Sc. (Mathematics Education) is a joint degree two year postgraduate programme jointly offered by University of Delhi and Jamia Millia Islamia. Cluster Innovation Centre (CIC), University of Delhi, administratively manages the program. The program aims to give the students some theoretical inputs and substantial hands-on experience in knowledge-making. The Degree course reflects a trans-disciplinary approach and promotes fresh viewpoints, making the learning and teaching process joyful and productive.

## **Introduction to CBCS (Choice Based Credit System)**

### **Choice Based Credit System:**

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Grading system provides uniformity in the evaluation and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations which enables the student to move across institutions of higher learning. The uniformity in evaluation system also enable the potential employers in assessing the performance of the candidates.

### **Definitions:**

- (i) 'Academic Program' means an entire course of study comprising its program structure, course details, evaluation schemes etc. designed to be taught and evaluated in a teaching Department/Centre or jointly under more than one such Department/ Centre
- (ii) 'Course' means a segment of a subject that is part of an Academic Program
- (iii) 'Program Structure' means a list of courses (Core, Elective, Open Elective) that makes up an Academic Program, specifying the syllabus, Credits, hours of teaching, evaluation and examination schemes, minimum number of credits required for successful completion of the program etc. prepared in conformity to University Rules, eligibility criteria for admission
- (iv) 'Core Course' means a course that a student admitted to a particular program must successfully complete to receive the degree and which cannot be substituted by any other course
- (v) 'Elective Course' means an optional course to be selected by a student out of such courses offered in the same or any other Department/Centre
- (vi) 'Open Elective' means an elective course which is available for students of all programs, including students of same department. Students of other Department will opt these courses subject to fulfilling of eligibility of criteria as laid down by the Department offering the course.
- (vii) 'Credit' means the value assigned to a course which indicates the level of instruction; One-hour lecture per week equals 1 Credit, 2 hours practical class per week equals 1 credit. Credit for a practical could be proposed as part of a course or as a separate practical course
- (viii) 'SGPA' means Semester Grade Point Average calculated for individual semester.
- (ix) 'CGPA' is Cumulative Grade Points Average calculated for all courses completed by the students at any point of time. CGPA is calculated each year for both the semesters clubbed together.

(x) 'Grand CGPA' is calculated in the last year of the course by clubbing together of CGPA of two years, i.e., four semesters. Grand CGPA is being given in Transcript form. To benefit the student a formula for conversation of Grand CGPA into %age marks is given in the Transcript.

## **M.Sc. (Mathematics Education) Program Details**

### **Program Objectives**

The M.Sc. (Mathematics Education) Programme would make the students competent various facets of Mathematics Education, including curriculum development, pedagogy and instructional resources (both hands on and technology based). The course will develop essential skill set in students to address the issues in Mathematics Education from multiple perspectives.

### **Program Learning Outcomes (PLO)**

PLO1 To move away from the conventional pedagogy of teaching mathematics especially at school level and to include methods of facilitating learning such as storytelling, projects, group work and participative learning.

PLO2 To use technology as significant aid in learning.

PLO3 To impart knowledge of some basic concepts and principles of the discipline.

PLO4 To establish inter-disciplinarily approach between Mathematics and other subjects from Humanities and the Social Sciences.

PLO5 To encourage collaborative learning through group activities and hands-on learning.

PLO6 To provide in-service training for school teachers.

PLO7 To learn to apply mathematics to real life situations and help in problem solving.

### **Program Structure**

The M.Sc. (Mathematics Education) program is a two-year course divided into four-semester. A student is required to earn 96 credits for the completion of course and the award of degree.

		<b>Semester</b>	<b>Semester</b>
<b>Part – I</b>	First Year	Semester I	Semester II
<b>Part – II</b>	Second Year	Semester III	Semester IV

Year Semester	Core Courses			Elective Courses			Open Elective Courses			Total Credits
	No. of papers	Credits Th/P/T	Total Credits	No. of papers	Credits Th/P/T	Total Credits	No. of papers	Credits Th/P/T	Total Credits	
1 <sup>st</sup> year Semester I	05	15+0+3	<b>18</b>	01	0+4+0	<b>04</b>	0	0	<b>00</b>	<b>22</b>
1 <sup>st</sup> year Semester II	06	15+4+5	<b>24</b>	00	0+0+0	<b>00</b>	01	02	<b>02</b>	<b>26</b>
2 <sup>nd</sup> Year Semester III	05	15+0+5	<b>20</b>	01	0+4+0	<b>04</b>	01	02	<b>02</b>	<b>26</b>
2 <sup>nd</sup> Year Semester IV	03	09+0+2	<b>11</b>	03	6+4+1	<b>11</b>	00	00	<b>00</b>	<b>22</b>
Total credits to be earned by the student in two years	<b>73</b>			<b>19</b>			<b>04</b>			<b>96</b>

\* For each Core and Elective course there will be 4 lecture hours of teaching per week.

\*For each Open Elective course there will be 2 lecture hours of teaching per week.

\* Student has to earn total of 96 credits to successfully complete the course that includes:

**73 credits from core courses;**

**19 credits from Elective courses;**

**4 credits from Open Elective course.**

\* Duration of examination for each 100 marks paper shall be of 3 hours and for each 50 marks paper will be of 2 hours.

\* Each 100 marks paper will be divided into 75 marks of theory (external exam) and 25 marks of internal assessment. Each 50 marks paper will be divided into 35 marks of theory (external exam) and 15 marks of internal assessment.

### Teaching:

- The faculty of the Cluster Innovation Centre is primarily responsible for conducting all kinds of teaching exercises. Teaching to the course will take place in different formats, lectures, tutorial, lab work, field work, projects, internships and research dissertation. Internships in schools and in various educational organizations will be supervised by the CIC faculty in addition to external mentors from the organizations.
- Innovation projects are an integral part of the course. Students can work in a group of maximum three or individually also. Each project/practicum will be closely

supervised by faculty of DU/JMI and Mentors who may be from outside the host institutions.

- Students can also choose project outside CIC which can be jointly guided by CIC/JMI faculty and external mentor.
- Tutorial will be conducted in small groups and each tutorial group will consists of maximum 10 students.
- Practical/ lab work will be done individually or in small groups under the guidance of the concerned faculty.
- One-hour lecture, tutorial, field work, project is equal to one credit.
- Two hour practical /lab work is equal to one credit.
- There shall be 90 instructional days excluding examination in a semester.

**Eligibility criteria:**

Graduate degree in any discipline provided the applicant has done at least two full-fledged papers in Mathematics at the undergraduate level.

**Admission Procedures:**

Admission will be through Entrance Test to be conducted by University of Delhi.

**Number of Seats & Reservation Policy:**

Twenty (20) Seats, reservation as per rules of the two institutions, wherever the student is admitted.\*

University of Delhi: 10

(In odd year: General: 5, OBC: 2, SC: 2, ST: 1)

(In even year: General: 5, OBC: 3, SC: 1, ST: 1)

Jamia Millia Islamia: 10

(General: 5, General Muslim: 3, Muslim OBC/Muslim ST: 1, Muslim Woman: 1)

- This will change as per EWS reservation as and when applicable.

**Per Semester Fee:**

To be determined mutually by partner universities i.e. University of Delhi and Jamia Millia Islamia. Presently fee is Rs.5000/- per semester.

### Assessment of Students' Performance and Scheme of Examinations:

1. English shall be the medium of instruction and examination.
2. Assessment will be based on Learning Outcomes for the course
3. Assessment of students' performance shall consist of:

Type of course	Assessment Scheme
Core course (Theory)	Internal assessment: 25 marks End term theory exam: 75 marks Duration of theory exam: 3 hours
Elective course (Theory)	Internal assessment: 25 marks External theory exam: 75 marks Duration of theory exam: 3 hours
Open Elective course (Theory)	Internal assessment: 12 marks External theory exam: 38 marks Duration of theory exam: 2 hours
Innovation Project (Semester I)	Planning phase presentation: 20 marks Mid phase (term) presentation: 20 marks Final presentation and viva voce exam: 30 + 30 marks
Innovation Project (Semester II)	Lesson planning: 30 marks Classroom teaching: 40 marks Viva voce exam: 30 marks
Innovation Project (Semester III)	a) <b><i>Internship in school (Small project taken up in school)</i></b> Internal Mentor: 30 marks External mentor: 30 marks Final presentation and viva voce exam: 40 marks b) <b><i>Internship in Educational organization</i></b> Internal Mentor: 30 marks External mentor: 30 marks Final presentation and viva voce exam: 40 marks
Innovation Project (Semester IV)	Synopsis presentation: 10 marks Mid- term presentation: 10 marks Marks by supervisor: 40 marks Final presentation and viva-voce exam: 40 marks

**Assessment for papers taught at Jamia Millia Islamia will be done by JMI only. It will be transferred/added in the final result.**

**Examination and result:**

The examination for papers studied by students at JMI will be conducted at JMI. \*

The examination for papers studied by students at DU will be conducted at DU.

Declaration of semester-wise result and issuing of Mark-sheets carrying logo of both DU and JMI shall be the responsibility of Examination Branch University of Delhi.

\* JMI examination branch will provide result of these papers to DU.

Elaborated examination scheme is given later in this document.

**Joint Degree of DU & JMI:**

On successful completion of the program, joint degree will be awarded to students enrolled in Meta University concept course M.Sc. (Mathematics Education). The joint degree shall carry the logo and signatures of competent authorities of both DU & JMI. The degree shall be in three languages: English, Hindi and Urdu.

**Coordination Committee for M.Sc. (Mathematics Education):**

As per UGC guidelines, there shall be a coordination committee constituted by participating universities for each Program.

The participating universities shall be responsible for deciding

- (a) Duration of Programme
- (b) Number of course required for the programme
- (c) Fee structure for the program
- (d) Number of students in the programme
- (e) Infrastructure requirements
- (f) (i) Framing syllabus
  - (ii) Number of Lectures and associated activities for the course
  - (iii) Number of credits for the course
  - (iv) Evaluation procedure
- (g) Any other related matter

The Coordination Committee shall ensure timely decision on the above issues and other related issues.

The composition of the Coordination Committee for Meta University concept program of DU & JMI namely M. Sc. (Mathematic Education) shall be:

1. The Director, Cluster Innovation Centre, DU (**Chairman**)
2. The Joint Director, Cluster Innovation Centre, DU (member)
3. Coordinator, Meta University Program, DU (**Member Secretary**)
4. Three nominated members from field of Education/Mathematics Education/ Mathematics/Media, DU (Members) (To be nominated by the Vice Chancellor, DU on the recommendation of the Director, Cluster Innovation Centre, DU)
5. Coordinator, Meta University Program, JMI\*
6. Three nominated members\* from field of Education/Mathematics Education/ Mathematics/Media, JMI (Members) (To be nominated by the Vice Chancellor, JMI)

\* One of the members from JMI will be designated as **Co-Chairman**.

**Assessment of Students' Performance and Scheme of Examinations:****Pass Percentage & Promotion Criteria:****Key: CC: Core Course; EC: Elective Course; OEC: Open Elective Course**

Semester I							
S. No.	Paper Title	Offering Centre	CC/EC/OEC	Credits	Total Marks	Marks Breakup	Pass Percentage
MME411CC	Calculus: Role in real life	CIC,DU	CC	4	100	Internal assessment (IA): 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME412CC	Perspectives in Mathematics Education	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75 marks	<b>40% in Total</b> 40% in Theory
MME413CC	Paper 1 from JMI*	AJKMRC, JMI	CC	3	<b>100</b>	As per JMI guidelines	
MME414CC	Paper 2 from JMI*	AJKMRC, JMI	CC	3	<b>100</b>	As per JMI guidelines	
MME415CC	Curriculum and Evaluation in Mathematics	CIC,DU	CC	4	<b>100</b>	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME416EC	Innovation Project-I: Interlinkin	CIC,DU/JMI	EC	4	<b>100</b>		<b>40% in Total</b>

	g Mathematics & real world problems						
<b>Semester II</b>							
MME421CC	Demystifying the power of data: Probability & Statistics	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME422CC	Theories of Learning	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME423CC	ICT in Mathematics Education	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME424CC	Learning Ways of Mathematical Writing	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME425CC	Art of Teaching Mathematics	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME426CC	Innovation Project: School Internship	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks	<b>40% in Total</b> 40% in Theory

						End term theory exam: 75marks	
MME427OEC	<b>OEC</b> <b>Option I:</b> <b>Innovation in Education</b> <b>OEC</b> <b>Option II:</b> <b>Mathematical Visualization</b>	CIC,DU	OEC	2	50	Internal assessment (IA) : 12 marks End term theory exam: 38 marks	<b>40% in Total</b> 40% in Theory
<b>Semester III</b>							
MME531CC	Discretizing and understanding Real Life Situations Through a Mathematical Lens	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME532CC	Pedagogical Intervention in Mathematics Classroom	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME533CC	Digital Technology in Mathematics Education	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME534CC	Research Methodology in Education	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory

MME535CC	Statistics in Educational Research	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME536EC	Innovation Project-III: Internship in Educational Setting	CIC, DU/ JMI	CC	4	100		<b>40% in Total</b>
MME537OEC	<b>OEC Option I:</b> Education Entrepreneurship for social change  <b>OEC Option II:</b> Education for Sustainable Future	CIC,DU	OEC	2	50	Internal assessment (IA): 12 marks End term theory exam: 38 marks	<b>40% in Total</b> 40% in Theory
<b>Semester IV</b>							
MME541CC	Understanding mathematical language of ordinary differential	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME542CC	Research Investigation in Mathematics Education	CIC,DU	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME543CC	Paper 3 from JMI*	JMI	CC	3	100	As per JMI guidelines	
MME544.1EC	Paper 4 from JMI*	JMI	EC	3	100	As per JMI guidelines	

MME545.1EC	<p><b>Option EC I:</b> Experimental Research Design</p> <p><b>Option ECII:</b> Descriptive Research Design</p>	CIC,DU	CC	4	100	Internal assessment (IA): 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory
MME546EC	Innovation Project: Research Dissertation	CIC,DU/ JMI	CC	4	100	Internal assessment (IA) : 25 marks End term theory exam: 75marks	<b>40% in Total</b> 40% in Theory

\* Refer to the list of courses to be opted from AJKMCRC, JMI.

Note: The decision to offer specific courses from the list or any other course approved by Academic Council of JMI varies from semester to semester. Syllabus of the papers to be opted from JMI presently is as per approved syllabi of AJKMCRC.

**Part I to Part II Progression:**

The passing percentage in any course shall be 40%. A student passing in at least 50% of courses in Semesters I and II combined shall be promoted to the second year of the Programme. A student who has at least 40% marks in the aggregate of all the required courses in the four semesters and has passed individually in courses accounting for at least 96 credits shall qualify for the award of the M.Sc. degree

**Conversion of Marks into Grades:**

As per University Examination rule

**Grade Points:**

Grade point table as per University Examination rule

**CGPA Calculation:**

As per University Examination rule.

**SGPA Calculation:**

As per University Examination rule.

**Grand SGPA Calculation:**

As per University Examination rule.

**Conversion of Grand CGPA into Marks:**

As per University Examination rule.

**Division of Degree into Classes:**

As per University Examination rule.

**Attendance Requirement:**

As per University rules

**Span Period:**

As per University rules

<b>Semester I</b>				
<b>Number of Core courses: 05</b>				
<b>Credits in each core course</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>	<b>Credits</b>
<b>MME411CC</b> Calculus: Role in Real life	03	00	01	04
<b>MME412CC</b> Perspectives in Mathematics Education	03	00	01	04
<b>MME413CC</b> Paper 1 from JMI*	As per the course approved by JMI			03
<b>MME414CC</b> Paper 2 from JMI*	As per the course approved by JMI			03
<b>MME415CC</b> Curriculum and Evaluation in Mathematics	03	00	01	04
<b>Total Credits in Core Courses: 18</b>	<b>15</b>	<b>00</b>	<b>03</b>	<b>18</b>
<b>Total Number of Elective courses: 01</b>				
<b>Credits in each Elective course</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>	<b>Credits</b>
<b>MME416CC</b> Innovation Project: Interlinking Mathematics and Real life Problems		04		04
<b>Total Credits in Elective Courses: 04</b>				
<b>Total Number of Open Elective courses: Nil</b>				
<b>Total Credits in Semester I: 22</b>				
Note				
<ul style="list-style-type: none"> <li>The student will study 3 core courses at CIC and 2 core courses (MME413CC &amp; MME414CC) at JMI.</li> <li>For paper MME416CC, the student will study theoretical underpinning of issues concerned with Math learning and its application at elementary, secondary and senior secondary level of schooling and further propose innovative solutions after real time field testing. The paper will be taught in project mode.</li> </ul>				
<b>Semester II</b>				
<b>Total number of Core courses: 06</b>				
<b>Credits in each Core course</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>	<b>Credits</b>
<b>MME421CC</b> Demystifying the power of data: Probability & Statistics	03	00	01	04
<b>MME422CC</b> Theories of Learning	03	00	01	04
<b>MME423CC</b> ICT in Mathematics Education	03	00	01	04

<b>MME424CC</b> Learning Ways of Mathematical Writing	03	00	01	04
<b>MME425CC</b> Art of Teaching Mathematics	03	00	01	04
<b>MME426CC</b> Innovation Project: School Internship	00	04	00	04
<b>Total Credits in Core Courses: 24</b>	<b>15</b>	<b>04</b>	<b>05</b>	<b>24</b>
<b>Total Number of Elective courses: Nil</b>				
<b>Total Number of Open Elective courses: One</b>				
<b>Credits in each Open Elective course</b>	Theory	Practical	Tutorial	Credits
<b>MME427OEC</b> Option I: Innovation in Education  Option II: Mathematical Visualization	02	00	00	02
<b>Total number of credits in Semester II: 26</b>				
Note				
<ul style="list-style-type: none"> <li>• The student will study all core courses at CIC.</li> <li>• The student will do School Internship which will continue till the month of July, semester III. School Internship will be guided, supervised and reviewed by the CIC faculty.</li> <li>• The student can take one Open Elective Course (MME427OEC) out of the two given options.</li> </ul>				

<b>Semester III</b>				
<b>Total number of Core courses: 05</b>				
<b>Credits in each Core course</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>	<b>Credits</b>
<b>MME531CC</b> Discretizing and Understanding Real Life Situations Through a Mathematical Lens	03	00	01	04
<b>MME532CC</b> Pedagogical Interventions in Mathematics Classroom	03	00	01	04
<b>MME533CC</b> Digital Technology in Mathematics Education	03	00	01	04

<b>MME534CC</b> Research Methodology in Education	03	00	01	04
<b>MME535CC</b> Statistics in Educational Research	03	00	01	04
<b>Total Credits in Core Courses: 22</b>	<b>15</b>	<b>00</b>	<b>05</b>	<b>20</b>
<b>Total Number of Elective courses: 01</b>				
<b>MME536EC</b> Innovation Project: Internship in Educational Setting	00	04	00	04
<b>Total Number of Open Elective courses: 02</b>				
<b>MME537OEC</b> Option I: Education Entrepreneurship for Social Change  Option II: Education for Sustainable Future	02	00	00	02
<b>Total number of minimum credits in Semester III: 26</b>				
Note: <ul style="list-style-type: none"> <li>Students will study all 5 core courses at CIC.</li> <li>For MME516EC, the student will do internship under the following themes: Hands-on: Minds-on Math learning tools; ICT embedded Math learning platform; Data as a resource for strengthening Math learning; Accessible Math curriculum for all</li> <li>The student can take one Open Elective Course (MME517OEC) out of the two given options.</li> </ul>				
<b>Semester IV</b>				
<b>Total number of Core courses: 03</b>				
<b>Credits in each Core course</b>	<b>Theory</b>	<b>Practical</b>	<b>Tutorial</b>	<b>Total Credits</b>
<b>MME541CC</b> Understanding mathematical language of ordinary differential equations and complex analysis	03	00	01	04
<b>MME542CC</b> Research Investigation in Mathematics Education	03	00	01	04

MME543CC Paper 3 from JMI*	03	00	00	03
<b>Total Credits in Core courses: 11</b>	<b>09</b>	<b>00</b>	<b>02</b>	<b>11</b>
<b>Total Number of Elective Courses: 03</b>				
Number of credits each Elective course	Theory	Practical	Tutorial	Total Credits
<b>Elective course from JMI</b>				
MME544EC Paper 4 from JMI*	As per the course approved by JMI			03
<b>Elective course in Research Design</b>				
MME545EC Option I: Experimental Research Design Descriptive Research Design  Option II: Innovation Project: Research Dissertation	03	00	01	04
MME546EC: Innovation Project: Research Dissertation	00	04	00	04
<b>Total number of credits in Elective courses: 11</b>	<b>06</b>	<b>04</b>	<b>01</b>	<b>11</b>
<b>Total number of credits in Semester IV: 22</b>				
<b>Note:</b>				
<ul style="list-style-type: none"> <li>The student will take 2 Core courses &amp; 2 Elective courses at CIC and 1 Core course (MME523CC) &amp; 1 Elective course (MME524EC) at JMI.</li> <li>The student can take any of the Elective course (MME525EC) out of the two given optional papers.</li> </ul>				

- Elective courses offered in the course fall under the following categories: Innovation Project, Field based Internship, Special Theory courses and Dissertation.
- Elective courses are compulsory optional courses. Elective courses are offered in Semester I, III and IV.
- Open Elective courses are choice based optional courses. A student has to choose any two Open Elective courses from the basket of four Open Elective courses offered in Semester II and III.
- The list of Elective courses offered, including open electives, may change from year to year depending upon the availability of faculty.

**Course Wise Content Details for M. Sc. Mathematics Education**  
**Master of Science in Mathematics Education**  
**(Courses taught at Cluster Innovation Centre, University of Delhi)**

**Semester I**  
**MME411CC: Calculus: Role in Real life**  
**Core course**  
**Number of credits: 4**  
**Marks: 100**

**Course Objectives**

Calculus is the most powerful tool in mathematics with widespread applications. The pedagogy of this paper is “think and then do”. The paper builds up on the topics, namely limits and continuity, differentiation and integration and then move on to more advanced applications in real life problems.

**Course content**

**Unit I:** Continuous compounding of interest, finding the circumference of circle from an n polygon inscribed in it, calculating the value of pi through limits, understanding of the ideas of limits and continuity graphically, calculating limits at infinity, indeterminate forms, special limits involving exponential and logarithmic functions, asymptotes; Improved facility in algebraic manipulation, graphing of quadric surfaces; Comparing the graphs of a function, its first derivative and its second derivative, sketching curves, solving optimization problems, fluency in differentiation, concavity and inflexion points, how derivatives affect the shape of the graph.

**Unit II:** Modeling average speed of traffic, temperature, population, etc., computing future value of a continuous income flow, flow of blood through an artery, fluency in integration, integration as a limit of a sum, volume of a frustum of a cone, cap of a sphere, volume of earth (not as a sphere but as an oblate spheroid). Staggered start of a race, Gabriel’s horn (finite volume but infinite surface area), parametric equations of curves, arc length and surface area.

**Unit III:** Path of a projectile, Kepler’s laws of planetary motion, and introduction of Vector valued functions, differentiation and integration of vector valued functions; Derivation of Newtonian formula of kinetic energy from Einstein’s special theory of relativity, modeling of a simple pendulum, understanding the ideas of sequences, infinite series including Taylor approximations.

**Unit IV:** Topographic maps, isothermal surfaces, functions of several variables, level curves and surfaces, limits and continuity of functions of two and three real variables, partial differentiation (two variables), partial derivative as a slope, partial derivative as a rate.

**Course Learning Outcomes:**

- A good understanding of application of Calculus to daily life problems
- Able to understand the basic concepts of calculus.

- Create projects using fundamental knowledge in order to provide a hands-on experience of the same.
- Able to plot and manipulate the curves on CSA

### **Reading list**

- T. M. Apostol Calculus, Volumes 1 and 2, Wiley Eastern, 1980.
- Hughes-Hallett et al., Calculus - Single and Multivariable, John-Wiley and Sons, 2003.
- James Stewart, Calculus, , Thomson, 2003.
- G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Addison-Wesley, 1998.

### **Semester I**

### **MME412CC: Perspectives in Mathematics Education**

#### **Core course**

**Number of credits: 4**

**Marks: 100**

### **Course Objectives:**

Mathematics is a discipline of multiple perspectives. Mathematics helps us to understand and organize things around us. Mathematics influences every aspect of human life but the way mathematics is taught in schools does not reflect the necessity, utility and aesthetics in Mathematics teaching. The beauty of Mathematics lies in its simplicity and freedom. The field of Mathematics Education looks into the pertinent gap between Essence of Mathematics and Teaching of Mathematics. The paper discusses the foundations of Mathematics and evolution of Mathematics Education in historical and socio-cultural perspectives.

### **Course Content:**

#### **Unit I: Nature, Philosophy and Foundation of Mathematics**

Study of dual Nature of Mathematics: from cognitive to social, Principals of Mathematics, Pure vs Applied Mathematics, Paradoxes in Mathematics, Philosophy of Mathematics and Mathematics Education, History and culture of Mathematics  
Philosophy of Mathematics Education, Mathematics Education in Social and Political context, Mathematics as an intellectual property vs Mathematics as a humanistic discipline, History of Mathematics in and for the curriculum, Mathematics and symbolization, Mathematics in popular culture, knowing in Mathematics

#### **Unit II: Structuration in Mathematics: Axiom, Postulate, Mathematical Statement, Language, Theorem and Proof**

Nature of mathematical ideas, Kinds of Mathematical statement, Mathematical Statements and proofs, Relation of Mathematics to logic, mathematical concepts and conceptual diversity, Primitive prepositions in Mathematics, Geometries and contradictions

#### **Unit III: Origin and development of Mathematical Ideas**

Evolution of numbers, Quantity and measurement, birth of algebra, emergence of calculus and beyond; beyond numbers: set theory; Infinity, Infinitesimal and Continuity

#### **Unit IV: School Mathematics in the changing world**

School Mathematics as social classification, Issues of equality and excellence in school mathematics, Gender stereotypes in Mathematics, Mathematics for future vs

Mathematics for appreciation, principles and Standards for school Mathematics, Mathematics literacy and Mathematics for all

**Practicum:**

- 1) Open House discussion on Strands and Contemporary Issues in School Mathematics
- 2) Education/ Review of one book from the suggested reading list

**Course Learning Outcomes**

- to develop sound understanding of foundations of nature of Mathematics;
- to develop understanding of philosophical, historical and sociological facets of Mathematics Education;
- able to identify various kinds of mathematical statements;
- able to trace developmental timeline of important mathematical concepts;
- able to discuss and analyze issues in school math education w.r.t cultural and social perspective.

**Essential Readings**

- *An Introduction to the History of Mathematics*, Third Edition by Howard Eves, Publisher: Cengage Learning (1990).
- *The Foundations of Mathematics* by Ian Stewart and David Tall, Oxford University Press (1977).
- *Mathematics: The Science of Patterns* By Keith Devlin, Scientific American Library (1997).
- National Curriculum Framework 2005

**Suggested Readings**

- *The Calculus Gallery, Masterpieces from Newton to Lebesgue* by William Dunham (Princeton University Press) (2008).
- *The Man Who Knew Infinity* by Robert Kanigel, Little Brown Book Group (1992).
- *What is Mathematics Really?* By Reuben Hersh, Oxford University Press (1999).
- *Does God Play Dice?* by Ian Stewart, Blackwell Publishing (1989).
- *A Concise History of Mathematics* by By Dirk Jan Struik, Courier Dover Publications (1987).
- *Universal History of Numbers* by Georges Ifrah, John Wiley & Sons (2000).
- *A Mathematician's Apology* by G.H. Hardy The Mathematical Experience by Philip J. Davis & Reuben Hersh, Cambridge University Press (2004).

**Semester I**

**MME413CC: Core Courses from Jamia Millia Islamia**

**Number of Credits: 3**

**Marks: 100**

**\*Refer to the list of courses to be opted from AJKMCRC, JMI**

**Semester I**  
**MME414CC: Core Courses from Jamia Millia Islamia**  
**Number of Credits: 3**  
**Marks: 100**

**\*Refer to the list of courses to be opted from AJKMCRC, JMI**

**Semester I**  
**MME415CC: Curriculum and Evaluation in Mathematics**  
**Core course**  
**Number of credits: 4**  
**Marks: 100**

**Course Objectives**

The broad aim of this course is to develop holistic understanding of “Education” as a developmental force and how the purpose of education conceptualizes the idea of curriculum selection and legitimization of formal curriculum content. It further facilitates the students’ understanding on social influences on the aims of education and its’ impact on the curriculum planning and implementation with focus on school Mathematics Curriculum. The course focuses on understanding aims of teaching Mathematics as continuum from narrow aims to higher aims; organization of Mathematics Curriculum (in the light of latest NCF, Position Paper on Teaching of Mathematics with special focus on twin premises of learning mathematics and universalization of schooling)

**Course Content**

**Unit I: Perspectives in Curriculum with reference to society, power and knowledge selection**

Analysis of curriculum as intent and as reality; curriculum as the reflection of educational ideas and aspirations to be operationalized; curriculum as means to provide experiences to realize educational proposal into practice, Analysis of assumptions: the nature of knowledge, the nature of the child and the nature of the society, Debate on selection of knowledge, Debate on competing conception of balance and development of individual needs and the needs of the society.

**Unit II: Process of curriculum development**

Analysis of models: ‘Objective model’ and Process model’, approaches to curriculum development: Role of central and state governments of India, Centralized and de-centralized curriculum development, Evaluation of curriculum as a whole.

**Unit III: Concept of a National Curriculum Framework vs National Curriculum**

Concept of curriculum framework, Kinds of curriculum framework, Curriculum in a democratic setup, Curriculum to facilitate and respect diversity, Concept of a National Curriculum Framework rather than a National Curriculum to help establish uniformity of democratic and secular norms, with the flexibility of approach and local contextually

**Unit IV: Understanding aims of teaching mathematics as continuum from narrow aims to higher aims**

Organization of Mathematics Curriculum (in the light of latest NCF, Position Paper on Teaching of Mathematics with special focus on twin premises of learning mathematics and universalization of schooling)

Practicum: Time line on development of reforms in Mathematics Education in India/  
Comparative analysis of International Mathematics Curriculum

### **Course Learning Outcomes**

- able to understand theoretical constructs of curriculum development;
- able to analyze curriculum development models;
- able to understand the role of various organizations in curriculum development process;
- able to conceptualize the idea and need of National Curriculum Framework;
- able to differentiate between narrow and higher aims of teaching Mathematics.

### **Essential Readings**

- *The Curriculum: Theory and Practice* by A.K. Valley, Sage Publication (2009).
- *Contemporary Issues in Curriculum (6th Edition)* by Allan C. Ornstein , Edward F. Pajak, Stacey B. Ornstein , Published by Pearson (2014).
- *Mathematics Curriculum in School Education* by Li, Yeping, Lappan, Glenda (Eds.)Springer Publishers, (2014).
- *Perspectives on the Design and Development of School Mathematics Curricula* Paperback by National Council of Teachers of Mathematics, (2007).

### **Suggested Readings**

- *Curriculum: From Theory to Practice* by Wesley Null Rowman & Littlefield, Rowman & Littlefield Publishers (2011)
- *Mathematics Curriculum: Issues, Trends, and Future Directions (Seventy-second Yearbook)*, by Barbara J. Reys, Robert E. Reys Rheta Rubenstein, Published by NCTM, (2010).
- *Critical Issues in Mathematics Education* Edited by: Paul Ernest, Brian Greer, Bharath Sriraman, Information Age Publishing (2009).

### **Semester I**

**MME416CC Innovation Project: Interlinking Mathematics and Real life Problem  
Core course**

**Number of credits: 4**

**Marks: 100**

### **Course objectives**

Student will study theoretical underpinning of issues concerned with Math learning and its application at elementary, secondary and senior secondary level of schooling and further propose innovative solutions after real time field testing. The paper will be taught in project mode.

Students need to identify and work on real time Math classroom problems or Math content related problems that can be solved through mathematical modeling and problem solving.

Option I: Solving real time problem/context that can be translated into mathematical model.

Option II: Concretizing abstract mathematical concepts using manipulative or technology.

Option III: Developing innovative Mathematics teaching learning resources.

Student can choose any one option and carry out the Innovation project out under the guidance of a mentor/mentors. Students can work in group of minimum two or maximum four.

### **Course Learning Outcomes**

- able to identify math classroom problems faced by teachers and students;
- able to develop mathematical models around the problems;
- able to plan need based solution to the identified problems;
- able to test and analyze the solutions in real time setting.

## **Semester II**

### **MME421CC Demystifying the Power of Data: Probability & Statistics**

#### **Core course**

**Number of credits: 4**

**Marks: 100**

### **Course Objectives:**

Uncertainty prevails in decision making, in testing compatibility of samples, and everywhere in day-to-day life. This paper aims to provide the basic understanding of the subject and the tools used to understand these uncertainties. The student will be able to fit, interpret, diagnose and predict simple real life models involving probability and statistics.

### **Course Content:**

**Unit I:** Sampling distributions, hypothesis testing, interval estimation, likelihood, analysis of categorical

**Unit II:** Data, joint, marginal and conditional distributions, ANOVA and regression.

**Unit III:** Computer program R and its application to simple models, Statistical procedures and their implementation through the statistical package R

**Unit IV:** Sampling distributions and randomness, likelihood analysis, bivariate, marginal and conditional distributions, curve fitting, linear regression, test statistic and their significance.

### **Course Learning Outcomes:**

- A good understanding of application of Statistics to daily life problems
- Able to understand the basic concepts of statistics
- Create projects using fundamental knowledge in order to provide a hands-on experience of the same.
- Able to work on statistical package R

### **Reading List**

- B. Bowker and G.J. Liberman, Engineering Statistics, Asia, 1972.
- R.V. Hogg and E.A. Tanis, Probability and Statistical Inference, Macmilan, 1983.
- N.L. Johnson and F.C. Xeen Leone, Statistics and Experimental Design in Engineering and the Physical Sciences, Vol. I and II, , Wiley Inter science, 1977.

**Semester II**  
**MME4212CC: Art of Mathematics Teaching and Evaluation**  
**Core course**  
**Number of credits: 4**  
**Marks: 100**

**Course objectives**

The context of learning plays an important role to foster creativity, logic and concept building. The humanistic and realistic approach developed through the paper is rooted in belief that learners construct the knowledge on their own in a stimulating environment. The role of teacher is to organize socially relevant and resourceful learning environment for active participation of learners. The paper emphasizes on developing pedagogical and assessment paradigms to facilitate math learning for all.

**Course content**

**Unit I: Theories of Teaching and learning of Mathematics**

Styles and strategies for teaching mathematics, theories of learning (Dewey, Bruner, Piaget, Denes, Vygotsky) connecting theory and practice in mathematics teaching, facilitating culture of learning in mathematics classroom

**Unit II: Addressing Pedagogical Concerns in Mathematics classroom**

Critical content of school mathematics: Numbers, Algebra, Geometry, Probability and Statistics, Calculus, limits and continuity with emphasis on research in teaching and learning

**Unit III: Assessment for Active Mathematics learning**

Models of assessment, Assessment for learning and assessment of learning, assessment for teaching, interpreting assessment, developing assessment plan for diverse learners

**Unit IV: Resources for Mathematics Teacher across Curriculum**

Mathematics as a discipline of interdisciplinary approach, creative ways of developing mathematical ideas across curriculum; Learning Mathematics through Minds on and Hands on, facilitating learning using active use of resources, developing innovative resources to develop mathematical ability (games, puzzles, models, hands on kits)

Practicum: Focused Discussion Forum to initiate dialogue and sharing on School Internship Experiences

**Course Learning Outcomes**

- able to understand theoretical framework for theories of teaching of Mathematics;
- able to learn the strategies to facilitate the culture of learning in math classroom;
- able to identify critical content areas in math classroom and to relate it to the research practices;
- able to understand different approaches of assessment;
- able to develop and interpret assessment plans for diverse abilities learners;
- able to develop content specific resources for math teachers.

**Essential Readings**

- Skemp R. (1987). *The Psychology of Learning Mathematics*. Lawrence E Hillsdale.
- Black P., Harrison C., Lee C. Marshall B. Wiliam. D (2003): *Assessment for Learning: Putting it into Practice*, Open University Press.
- *Inside the Black Box: Raising Standards Through Classroom Assessment* (2005) by Dylan Wiliam, Published by NFER Nelson.
- Mitchelmore M. & White P.(2010) *Teaching Mathematical Concepts: Instruction for Abstraction*. Australian Catholic University National, Sidney Australia.

**Suggested Readings**

- Hiebert & Lefevre (1986). *Conceptual and Procedural Knowledge in Mathematics: An Introductory Analysis* by J. Hiebert (eds.) *Conceptual and Procedural Knowledge: The case of mathematics*. pp.1-27.
- Davis R. B. (1983). *Complex Mathematical Cognition* In H. P. Ginsburg (eds.) *The Development of Mathematical Thinking*. New York: Academic press. pp. 253-290.
- Resnick, L. B., & Ford, W. W. (1981). *The Psychology of Mathematics for Instruction*. NJ: Lawrence Erlbaum.
- Cobb P. (1994). *Where Is the Mind? Constructivist and Socio-cultural Perspectives on Mathematical Development*. *Educational Researcher*, Vol. 23(7), pp. 13-20.
- John-Steiner V. & Mahn H.(1996). *Socio Cultural Approaches to Learning and Development: A Vygotskian Framework*. *Educational Psychologist*.
- Bell E. T. (1940): *The Development of Mathematics*, New York, McGraw Hill.

**Semester II**

**MME423CC: ICT in Mathematics Education**

**Core course**

**Number of credit: 4**

**Marks: 100**

**Course objectives**

Technology has changed the course of education. Effective use of technology can do a lot to benefit learners. The paper focuses on developing appropriate understanding, well coordinate and sound pedagogical knowledge to make judicious uses of technological tools for teaching mathematics beyond boundaries.

**Course content**

**Unit I: Potentials of ICT in Mathematics Education**

ICT as a change agent, Place and purpose of technology in the curriculum, Means of ICT, technology embedded pedagogy

**Unit II: ICT for enhanced learning**

Content planning using ICT, Role of ICT in content differentiation, ICT and self-paced learning, Use of ICT in inclusive classroom

**Unit III: Safety issues in use of ICT**

Technology in the hands of teacher and student, connectivity through ICT on campus and off campus, learning space, e-content versus authentic information

### **Course Learning Outcomes**

- able to understand the scope of ICT in education;
- able to identify means of ICT;
- able to learn and use ICT tools in teaching;
- able to use ICT to support inclusion in classroom;
- sensitized towards the misuse of ICT in learning situations.

### **Essential Readings**

- Introduction to Information and Communication Technology in Education (2005) E-book by David Moursund , Teacher Education, University of Oregon
- ICT in Primary Education: Analytical survey(2012) by UNESCO
- Research on e-Learning and ICT in Education(2012) by Jimoyiannis, Athanassios (Ed.), published by Springer
- Teaching Mathematics Using ICT 3<sup>rd</sup> Edition (2010) by Adrian Oldknow Ron Taylor Linda Tetlow , published by Continuum International Publishing Group.

### **Suggested Readings**

- ICT: Changing Education (2001) by Chris Abbott, Psychology Press.
- Technology, Innovation, and Educational Change: A Global Perspective: A Report of the Second Information Technology in Education Study, Module 2 (2003) by Robert B. Kozma published by International Society for Technology in Education.
- Teaching Secondary Mathematics with ICT (2004) by,Sue Johnston-Wilder, David Pimm, McGraw-Hill International.
- Teaching Mathematics Using ICT 3<sup>rd</sup> Edition (2010) by Adrian Oldknow Ron Taylor Linda Tetlow , published by Continuum International Publishing Group.

## **Semester II**

### **MME424CC: Learning Ways of Mathematical Writing**

#### **Core course**

**Number of credit: 4**

**Marks: 100**

### **Course Objectives**

Mathematics is a sophisticated language written with lots of precision and accuracy. It follows certain rules which need to be followed by people who would like to write good mathematical content. The paper focuses on the art of mathematical writing to enable students to write quality content that is conceptually and pedagogically sound. The paper will focus on learning of software on mathematical writing.

#### **Unit I: Mathematics as a language and expression**

Exploring mathematical ideas from language lens, features of mathematical language, evaluation of algebraic symbolism

#### **Unit II: Basics of mathematical writing**

Essential rules of mathematical writing, technical aspect of mathematical writing, adding creativity in mathematical content

### Unit III: Mathematical writing software

Writing on computer using software, namely, LateX, MathWriter, MathType

### Unit IV: Learning through exemplary pieces of mathematical writings

Critical analysis of mathematical content in textbooks, reference books and research based books, Review of exemplary pieces of mathematical writing

### Course Learning Outcomes

- able to understand structure of mathematics as a language;
- able to differentiate between good and poor definition of a mathematical concept;
- learn the way of effective mathematical writing;
- able to appreciate creativity in mathematical writing;
- learn to use math writing software, Latex and others.

### Essential Readings

- Introduction to Mathematical Writing by Franco Vivaldi, School of Mathematical Sciences, The University of London, 2014.
- Handbook of *Writing* for the *Mathematical* Sciences (1998) by Nicholas J. Higham, Published by The Society of Industrial and Applied Mathematics.
- Steven G. Krantz, *A primer of mathematical writing: being a disquisition on having your ideas recorded, typeset, published, read and appreciated*, American Mathematical Society, 1997.

### Suggested Readings

- David K Pugalee, Writing, mathematics, and metacognition: Looking for connections through students' work in mathematical problem solving, *School Science and Mathematics*, May 2001.
- Donald E. Knuth, Tracy Larrabee, and Paul M. Roberts, *Mathematical writing*, Mathematical Association of America, 1989.
- John Meier and Thomas Rishel, *Writing in the Teaching and Learning of Mathematics*, Mathematical Association of America, 1998.
- Candia Morgan, *Writing Mathematically : The Discourse of 'Investigation'* (Studies in Mathematics Education), Falmer Press, 1998.

**Semester II**  
**MME425CC: Theories of learning**  
**Core course**  
**Number of credits: 4**  
**Marks: 100**

**Course objectives**

The students will be able to:

- understand the relevance of psychological perspective of learning;
- get acquainted with the process of learning in children;
- understand the dynamics of learning with reference to education;
- apply the learning principles in classroom situations.

**Course content**

**Unit I: Psychology of learning**

- Learner and Learning - Nature, meaning and scope

**Unit II: Approaches to learning**

- Behavioristic, Cognitive and Humanistic

**Unit II: Theories of learning**

- Pavlov's, Skinner's and Gestalt theories of learning.
- The Social Cognitive Theory with special reference to Bandura, Dollard and Miller.
- Transformative Learning Theory with special reference to Jack Mezirow
- Social Development theory (Vygotsky), Discovery Learning
- Experiential Learning theory (Kolb),
- Cognitivist Learning Theories: Attribution theory (Weiner), Metacognition (Flavell), E-Learning Theory, Gamification in Education, The Information Processing Theory with special reference to Ausubel and Bruner.

**Unit IV: Constructivism and Learning**

Meaning and scope of constructivism; learning styles and their relevance to learning

**Essential Reading**

- Olson, M.H. & Hergenhann (2013). Theories of Learning; New Delhi: PHI Learning Pvt. Ltd.
- Schunk, H.D. (2014). Learning Theories: An Educational Perspective. Harlow, England; Pearson Publisher.

**Suggested Reading**

- Bates, B. (2016). Learning Theories Simplified and how to apply them to teaching. New Delhi; Sage Publication.

**Semester II**  
**MME426CC: Innovation Project: School Internship**  
**Core course**  
**Number of credits: 4**  
**Marks: 100**

This project will be carried out in schools as Integrated School Internship Project to experience Mathematics teaching and learning, understanding classroom behavior and

issues in assessments. School Internship will be guided, supervised and reviewed by the CIC faculty. Internship will include planning discourse, classroom engagement and reflection practices.

## **Semester II**

### **MME427OEC (Option I): Innovation in Education**

#### **Open Elective Course**

**Number of credit: 2**

**Marks: 50**

#### **Course Objectives:**

Innovation in Education is important to solve many contemporary challenges faced by the country today. The course aims to develop an insight into the process of developing innovative ideas; how to deconstruct standardized procedures and think more open, creative and out of box ideas to target realistic problems of education.

#### **Unit I: Understanding concept of Innovation**

Conceptualizing innovation in terms of: Learning; Teaching; Society; Industry; Essentials of innovation; Innovation as an idea, product or process; Innovation and need of society; Innovation and technology

#### **Unit II: Creating an environment for Innovation**

Factors responsible for innovation; Need identification and working for innovation; Support system to promote innovation; Implementing changes for promoting innovation; Innovation by practice

#### **Course Learning Outcomes**

- able to conceptualize the idea of innovation;
- able to identify factors responsible for innovation;
- able to understand the need and scope of innovation in educational practices.

#### **Essential Readings**

- Education for Innovation and Independent Learning by David Scott and Ronaldo Mota; published by Elsevier, 2014.
- Creating Innovators: The Making of Young People Who Will Change the World by Tony Wagner; published by Simon & Schuster Audio 2012.

#### **Suggested Readings**

- Where Good Ideas Come from: The Natural History of Innovation by Steven Johnson, Riverhead Books, 2010.

**Semester II**  
**MME427OEC (Option II): Mathematical Visualization**  
**Open Elective Course**  
**Number of credits: 2**  
**Marks: 50**

**Course objectives:**

To increase an awareness of patterns and the Mathematics that pervades the world around us.

**Course content:**

**Unit I: Symmetry**

Geometrical definition of symmetry; Symmetry around us; Symmetry of finite plane figures; Symmetry of wall paper patterns; Symmetry groups; Symmetry in monuments and ornamental art.

**Unit II: Linear Perspective and Projection**

Mathematical principles of linear perspective and projection; One, two and three point linear perspective; Vanishing points; Duplicating simple geometric figures (circle and polygons) in one and two point perspective; Finding the viewing point of a painting in one point perspective.

**Course Learning Outcomes:**

- Understanding symmetries present in various art forms and architecture
- Appreciate paintings from a Mathematical point of view
- Able to draw simple geometrical figures in perspective

**Essential Reading**

- Mark Frantz and Annelisa Crannell, *Viewpoints: Mathematical Perspective and Fractal Geometry in Art*, Princeton University Press, 2011.
- Dan Pedoe, *Geometry and the Visual Art*, New York: Dover Publication, 2011.
- Bagai,S.,Habib,A. & Venkataraman,G. A Bridge to Mathematics, Sage Publications, 2017.

**Suggested Readings**

- David W Farmer, *Groups and Symmetry*, India: University Press, 1998.
- Marcus Du Sautoy, *Symmetry: A journey into the patterns of nature*, USA harper Collins, 2008.

**Semester III**  
**MME531CC: Discretizing and Understanding Real Life Situations through**  
**Mathematical Lens**  
**Core Course**  
**Number of credits: 4**  
**Marks: 100**

**Course objectives**

In modern world, most jobs involve interaction with computers. The computing and embedded systems technologies break additional barriers; even the day to day life and common activities now involve interacting with a computing device.

**Course content**

**Unit I:** Graphs (bipartite, Euler, Hamiltonian, Planar), Euler's  $V-E+F=2$  Theorem, subdivisions, Kuratowski's Theorem,

**Unit II:** Matching, Hall's Marriage Theorem, assignment problems, counting sets, subsets, multisets, inclusion/exclusion, applications

**Unit III:** Vectors and geometry, Systems of linear equations, echelon form, Gaussian elimination, linear independence.

**Unit IV:** Matrices, multiplication, transpose, inverses, linear maps. Intro to subspaces and bases, Rank, Eigenvalues and eigenvectors, Determinants

**Course Learning Outcomes:**

- Understanding of basic concepts and application of Graph theory
- Able to understand the geometrical concepts of Linear Algebra
- Create projects using fundamental knowledge in order to provide a hands-on experience of the same.
- Able to work on CAS

**Reading list**

- Linear Algebra and its Applications, D. C. Lay, Addison Wesley, 2005.
- A Modern Introduction, David Poole, Linear Algebra, Brooks Cole, 2011.
- Discrete and Combinatorial Mathematics, Ralph Grimaldi, International Edition, 2003.
- Discrete Mathematics and Its Applications, K. H. Rosen, McGraw-Hill, 2008

### Semester III

#### MME532CC: Pedagogical Intervention in Mathematical Classroom

#### Core Course

Number of credits: 4

Marks: 100

#### Course objectives

The course aims to enable students to use/develop need based pedagogical strategies and teaching learning resources for an inclusive classroom. It will focus on learning needs of differently abled learners.

#### Course content

##### Unit I: Framework for inclusive classroom

Diversity in Mathematics classroom; Mathematics for all; Accessible curriculum.

##### Unit II: Fundamentals of pedagogical intervention

Pedagogical intervention as a process; Pedagogical intervention vs Instructional strategy; Pedagogical intervention vs Accommodation.

##### Unit III: Need and scope of Differentiation

Strategies for differentiation and student engagement; Strategic grouping and collaborations; Purposeful use of technology to support learning.

##### Unit IV: Bridging the achievement gap

Need based teaching resources using visual; tactile; auditory; kinematic; Curriculum for advanced learner using acceleration and enrichment.

#### Course Learning Outcomes

- able to understand meaning of diverse ability learners
- conceptualize framework of an inclusive classroom
- able to learn strategies of differentiation in an inclusive classroom
- able to develop need based resources for differently abled learners, including double exceptional

#### Essential Readings

- Riccomini, P. J. (2009). Response to Intervention in Mathematics. Corwin Publisher.
- Hudson, P.P. and Peterson Miller, S. (2005). Designing and Implementing Mathematics Instruction. Pearson, 2005.
- Alisopp, D. Kyger, M. & L. H. Louann. (2007). Teaching Mathematics Meaningfully: Solution for reaching struggling learners (2<sup>nd</sup> Edition). Brookers Publishing.
- Boaler, J. and Dweck, C. (2015). Mathematical Mindsets: Unleashing Students' Potential through Creative Mathematics, Inspiring Messages and Innovative Teaching. Jossey-Bass Publishers.

#### Suggested Readings

- Principles to Actions: Ensuring Mathematical Success for All. (2014). National Council of Teachers of Mathematics.
- Chinn, S. (2017). The Routledge International Handbook of Dyscalculia and Mathematics Learning. Routledge Publishers.

**Semester III**  
**MME533CC: Digital Technology in Mathematics Education**  
**Core Course**  
**Number of credits: 4**  
**Marks: 100**

**Course objectives**

Technology including multimedia is an asset to expand the reach of classroom teaching. The paper builds up pedagogical orientation to integrate use of digital technologies into mathematics classroom. The paper gives an opportunity to develop creative resources using available technology such as software & applets to foster critical thinking in learning Mathematics.

**Course content**

**Unit I: ICT embedded Mathematics Pedagogy**

Content specific mathematics pedagogies using digital resources, web-based innovations

**Unit II: Digital Technology in Mathematics Classroom**

Designing web-based learning environment (web-site, blogs, virtual classroom etc)

**Unit III: Exploring Mathematics through online resources**

Learning software for mathematics teaching and content design (CMAP, Geometer, Sketchpad, Geogebra, Graphing Calculator 3D, Captivate, Photoshop, Coral Design)

**Unit IV: Content development**

Preparing E-content/E-resource/E-assessment/web-based classroom

**Essential Reading List**

- The Mathematics Teacher in the Digital Era (Vol II) (2014) by **Clark-Wilson**, Alison, **Robutti**, Ornella, **Sinclair**, Nathalie (Eds.), Published by Springer.
- Mathematics Education with Digital Technology (2011) by: Adrian Oldknow, Published by Continuum.

**Suggested Readings**

- Research on e-Learning and ICT in Education (2012) by **Jimoyiannis**, Athanassios (Ed.), published by Springer.

**Semester III**  
**MME534CC: Research Methodology in Education**  
**Core Course**  
**Number of credits: 4**  
**Marks: 100**

**Course objectives**

The paper focuses on idea of research in education and various research designs highlighting the quantitative and qualitative methods of data collection and data analysis. It also sensitizes students into the challenges of carrying out research in the field of education. Students are expected to do micro research project in educational setting to connect theory into practices.

**Course content**

**Unit I: Introduction to Educational Research**

Research as source of inquiry, role of research in the field education, qualitative and quantitative paradigms of research, Types of research (experimental, descriptive and action research); Role of theory in research.

**Unit II: Research Paradigms and Design**

Research design in educational research, sampling and techniques in data collection and data analysis, objectivity, reliability, validity and statistical inferences.

**Unit III: Understanding Research Processes**

Steps in carrying out research, research planning, writing proposal, review of literature, hypothesis, tools design, data collection and analysis, report writing.

**Unit IV: Learning to write research proposal**

Writing and defending a research proposal/ Micro research project

**Course Learning Objectives**

**Essential Reading**

- Best, J. and Kahn, J. (2012). Research in Education (10<sup>th</sup> Edition). PHI learning Private Limited.
- Reason, P. & Bradbury, H. (Eds) (2006). Handbook of action research: Concise paperback edition: Thousand Oaks, CA: Sage.
- Research Methods in Education (5th Edition) 2000 by **Louis Cohen**, **Lawrence Manion**, **Keith Morrison** by Routledge Falmer
- Clive Opie (2004). Doing Educational Research- A Guide for First time researchers. New Delhi: Vistar Publications.
- Cohen, Manion & Morrison (2003) Research Methods in Education ( V Edition) , Published by Taylor & Francis

**Suggested Readings**

- Fraenkel, J.R., Wallen, N.E. (1996). How to Design and Evaluate Research in Education. New York: McGraw Hill.
- Stake, Robert E. (1995). The Art of Case Study Research. Thousand Oaks: C.A: Sage.

- Reason, P. & Bradbury, H. (Eds) (2006). Handbook of action research: Concise paperback edition: Thousand Oaks, CA: Sage.
- Christensen, L. (2007). Experimental Methodology. Boston: Allyn & Bacon.
- Borg, W.R. and Gall, M.D. (1983). Educational Research – An Introduction, New York: Longman, Inc.
- Sharma, S.R. (2003). Problems of Educational Research. New Delhi: Anmol Publications Pvt. Ltd.

### **Semester III**

#### **MME535CC: Statistics in Educational Research**

#### **Core Course**

**Number of credits: 4**

**Marks: 100**

#### **Course objectives**

The course will focus on descriptive & inferential statistics and quantitative & qualitative data analysis. It enables students to apply statistical methods in educational research.

#### **Course content**

##### **Unit I: Meaning and scope of Statistics**

Measurement scales; Parametric and Nonparametric Data; Descriptive and Inferential Analysis.

##### **Unit II: Descriptive Statistics**

Representing data (Frequency distribution; Cumulative distribution and Histogram) ; Measurement of Central Tendency and its 'interpretation, Measure of dispersion (Variance and Standard Deviation) and its' interpretation; Standard Scores (Z score; T Score, Percentile score and Percentile rank); Normal Probability curve and its 'applications; Measure of correlation (Product movement correlation and Rank order correlation) Scatter-gram and Regression line; Interpreting coefficient of correlation and making prediction using standard error of estimate

##### **Unit III: Inferential Statistics**

The central limit theorem; Testing null hypothesis; Significance of difference between the means; level of significance; Degree of freedom; One sample Z test; Significance of difference between means of two small and independent samples; Significance of difference between means of two matched or correlated groups (non- independent samples); Statistical significance of coefficient of correlation.

##### **Unit IV: Data analysis and interpretation**

Using case studies with real time data from education setting and making inferences

### **Essential Readings**

- Best, J. and Kahn, J. (2012). Research in Education (10<sup>th</sup> Edition). PHI learning Private Limited.
- Pyrczak, F. (2014). Making sense of statistics: A conceptual overview (6<sup>th</sup> Edition). Routledge.
- Garrett, H. E. (2006). Statistics in Psychology and Education. Cosmo Publication.
- Creswell, W.J. and Creswell, J. D. (2018). Research Design: Qualitative, Quantitative and Mixed Methods. Sage Publications.

### **Suggested Readings**

- Evergreen, S. (2016). Effective Data Visualization. Sage Publication.
- Mills, G. E. and Gay, E. R. (2018). Educational Research: Competencies for Analysis and Applications (12<sup>th</sup> Edition). Pearson.
- Coladarci, T. and Cobb, C.D. (2013). Fundamentals of Statistical Reasoning in Education (4<sup>th</sup> Edition). Wiley Publishers.

### **Semester III**

#### **MME536EC. Innovation Project: Internship in Educational Setting**

##### **Elective Course**

**Number of credits: 4**

**Marks: 100**

The course will be carried out as an internship project in government educational organization/ schools/ special schools/ alternate educational organization to experience developmental perspectives in mathematics education under the following themes: Hands-on: Minds-on Math learning tools; ICT embedded Math learning platform; Data as a resource for strengthening Math learning; Accessible Math curriculum for all. The project will be carried out under the guidance of mentor.

### **Semester III**

#### **MME537OEC (Option I): Education Entrepreneurship for Social Change**

##### **Open Elective Course**

**Number of credits: 2**

**Marks: 50**

### **Course objectives**

The course aims to develop entrepreneurship skills among students to turn educational challenges into social impact initiatives. The skills include: identifying opportunities for educational change; planning the framework and evaluating the plans for practical feasibility.

### **Course content**

#### **Unit I: Meaning and scope of Education Entrepreneurship**

Definition of Education Entrepreneurship; social impact models of entrepreneurship; skills for entrepreneurship

## **Unit II: Opportunities for Education entrepreneurship**

Issues and challenges in education; developing viable entrepreneur models to create educational opportunities for disadvantaged section of society; entrepreneurship using technology and localized resources.

### **Course Learning Outcomes**

- able to define education entrepreneurship;
- able to analyse social impact models of entrepreneurship;
- able to understand the scope and challenges in education entrepreneurship.
- able to understand the role of education in sustainable development;
- able to appreciate the need and scope of curriculum for a sustainable future.

### **Essential Readings**

- Handbook of Research in Entrepreneurship Education: **International Perspectives** by Alain Fayolle, Edward Elgar Publishing Limited, 2010.
- Entrepreneurship Education: Experiments with Curriculum, Pedagogy and Target Groups by Mathew J. Manimala, Princy Thomas, Springer Singapore, 2017.

### **Suggested Readings**

- Social Entrepreneurship as a catalyst for social change edited by Charles Wankel, Ph.D., .Larry E. Pate, Information Age Publishing, 2013
- Education in Emerging Indian Society: Challenges and Issues by Sunada Ghosh and Radha Mohan (2<sup>nd</sup> Edition), PHI learning private limited, 2015.

**Course Code:**  
**MME537OEC (Option II): Education for Sustainable Future**  
**Open Elective Course**  
**Number of credits: 2**  
**Marks: 50**

### **Course objectives**

The course aims to sensitize students for the need of sustainable future and the role of education in developing knowledge, skills and values for sustainable development for all.

### **Course content**

#### **Unit I: Education as catalysts for a sustainable future**

Environmental sustainability; Economic sustainability; Social sustainability; Aims and objectives for sustainable future.

#### **Unit II: Curriculum for sustainable future**

Diversifying curriculum around critical areas for interventions to achieve sustainable development goals; Pedagogical strategies to meet the curriculum needs; Practicing sustainability.

### **Course Learning Outcomes**

- able to understand the role of education in sustainable development;
- able to appreciate the need and scope of curriculum for a sustainable future.

### **Essential Readings**

- Education for Sustainable Development: Challenges, Strategies and Practices in a Globalizing World Edited by: Anastasia Nikolopoulou; Taisha Abraham and Farid Mirbagheri, published by Sage Publication, 2018.
- Textbooks for Sustainable development by UNESCO, MGIEP, 2017.

### **Suggested Reading**

- Teaching Education for Sustainable Development at University Level by Leal Filho, Walter, Pace, Paul (Eds.), Springer, 2016.

## **Semester IV**

### **MME541CC: Understanding Mathematical language of Ordinary Differential Equations and Complex Analysis**

#### **Core Course**

**Number of credits: 4**

**Marks: 100**

### **Course objectives**

Modeling is the process through which real life problems are converted to the mathematical language. This paper aims to develop techniques required to study the models involving differential equations. The methodology will be to first analyze and understand the problem, then write down the governing equations, solve them and then analyze the solution. The problems will be picked up from engineering, ecology, medicine, etc.

### **Course content**

**Unit I:** Application of first order differential equation to draining a tank, harvesting of renewable natural resource, indoor temperature oscillation, flight trajectory, survivability with aids.

**Unit II:** System of linear differential equations applied to mechanical systems, electrical network, drug assimilation into the blood, solution of a linear system (in non-degenerate cases) using Eigen pairs, Modeling two-axle automobile, earthquake induced vibrations of a multistory building, evaluation and application of matrix exponential (in non-degenerate cases)

**Unit III:** Planar autonomous linear systems with graphical representation (in non-degenerate cases), Planar non-linear system applied to ecological models, wildlife conservation preserve, mechanical systems, epidemic models, determination of stability and classification of equilibrium of a planar nonlinear system by linearization.

**Unit IV:** Complex numbers and their geometrical interpretation, polar forms, powers and roots.

### **Course Learning Outcomes:**

- Able to explain and formulate real life problems as ODEs
- Understand the concepts of ordinary differential equations to solve physical models, biological models and ecological models.
- Able to understand the stability of systems of equation

- Visualise the qualitative behavior of the solutions of ODE
- Understand and visualise the geometrical interpretation of complex numbers

**Reading list:**

- T. M. Apostol Calculus,, Volume 2, Wiley Eastern, 1980.
- W. E. Boyce and R. DiPrima, Elementary differential equations, John Wiley, 2005.
- C.H. Edwards and D.E. Penny, Differential equations and boundary value problems:
- Computing and modeling, Pearson education (Singapore), Pte. Ltd., 2005.
- E. Kreyszig, Advanced engineering mathematics, John Wiley, 1999.

**Semester IV**

**MME542CC: Research Investigations in Mathematics Education**

**Core Course**

**Number of credits: 4**

**Marks: 100**

**Course objectives**

The paper highlights the significant features of mathematics education as a dynamic research field. It lays emphasis on developing critical understanding on issues and investigations in mathematics curriculum, pedagogy and assessment.

**Course content**

**Unit I: Trends and Issues in Mathematics Education Research**

Mathematics Educations as a dynamic field with growing input from research, place and purpose of mathematics education research, trends in mathematics education, ethical issues in mathematics education research

**Unit II: Interdisciplinary Research in Mathematics Education**

Exploring potential research area, research design in Mathematics Education; Debates in Mathematics Education

**Unit III: International Organizations working in Mathematics Education**

Comparative, Collaborative and Cross cultural research in Mathematics Education

**Unit IV: Learning from existing research practices**

Reviewing seminal research work in Math education

**Essential Readings**

- Keith L (2013) Vital Directions for Mathematics Education Research, Published by Springer
- Clements, M.A.(Bishop, A., Keitel-Kreidt, C., Kilpatrick, J.,Leung (2013) Third International Handbook of Mathematics Education
- Journal for Research in Mathematics Education
- Journal of Research in Mathematics
- Mathematics Teaching

**Suggested Readings**

- Lyn D (Ed) (2008): Handbook of International Research in Mathematics Education, Published
- School Science and Mathematics
- The Mathematics Matter

**Semester IV  
Courses MME543CC**

**Core course**

**Number of credits: 3**

**Marks: 100**

**\*To be taken from list of papers offered by AJKMCRC, JMI**

**Semester IV  
Courses MME544EC**

**Elective course**

**Number of credits: 3**

**Marks: 100**

**\*To be taken from list of papers offered by AJKMCRC, JMI**

**Semester IV**

**Elective course in Research Design**

**MME545EC (Option I): Experimental Research Design**

**Elective course**

**Number of credits: 4**

**Marks: 100**

**Course objective**

The course will equip the students with foundations of experimental research design including its need and feasibility. Students will be able to learn about different types of experimental designs and constraints of experimental designs in educational setting.

**Course content**

**Unit I: Fundamentals of experimental research**

Randomization, Control and Manipulation; Experimental and control group; Independent and dependent variable; Confounding variables (intervening and extraneous variables); controlling extraneous variables; Experimental variability and threats to experimental validity.

**Unit II: Pre-Experimental Design**

One shot case design; One group pretest-posttest design; Static group comparison design; limitations of pre-experimental design.

**Unit III: True experimental design**

Posttest (equivalent group) design; Pretest-posttest (equivalent group) design; The Solomon four-group design; Crossover design; Advantages and disadvantages of true experimental research design.

#### **Unit IV: Quasi- experimental design**

Pretest-posttest (Non- equivalent group) design; Time series design; The equivalent Time-Sample Design; Equivalent materials- Pretest-posttest design; Counterbalanced design; Advantages and disadvantages of true experimental research design.

#### **Course Learning Outcomes**

- able to understand fundamentals of experimental research design;
- able to plan one shot case design, one group pretest-posttest design, static group comparison design;
- able to design true experimental design;
- able to design quasi experimental design.

#### **Essential Readings**

- Stanley, J. C. and Gage, N.L. (1963). *Experimental and Quasi Experimental Designs for Research*. Boston: Houghton Mifflin.
- Creswell, W.J. and Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative and Mixed Methods*. Sage Publications.
- Kerlinger, F. N. (2017). *Foundations of Behavioural Research*. Surjeet Publications.
- Best, J. and Kahn, J. (2012). *Research in Education (10<sup>th</sup> Edition)*. PHI learning Private Limited.

#### **Suggested Readings**

- Kirk, R.E. (2012). *Experimental Design: Procedures for Behavioural Sciences (4<sup>th</sup> Edition)*. Sage Publication.
- Kennedy, C. (2004). *Single Case Design for Educational Research*. Pearson.

### **Semester IV**

#### **Elective course in Research Design**

#### **MME545EC (Option II): Descriptive Research Design**

#### **Elective course**

**Number of credits: 4**

**Marks: 100**

#### **Course objectives**

The course will equip the students with foundations of descriptive research design including its need and feasibility. Students will be able to learn about different types of descriptive designs and constraints of descriptive designs in educational setting.

#### **Course content**

##### **Unit I: Fundamentals of descriptive research:**

Features and characteristics and scope of descriptive research.

##### **Unit II: Different kinds of descriptive research designs (Part: I)**

- Casual- comparative research design;
- Correlational research design;
- Longitudinal research design;

**Unit III: Different kinds of descriptive research designs (Part: II)**

- Ethnographic research design;
- Case study design;
- Document analysis design.

**Unit IV:** Advantages and disadvantages of descriptive research

**Course Learning Outcomes**

- able to understand fundamentals of descriptive research design;
- able to justify the feasibility of different kinds of descriptive research designs;
- able to plan different kinds of descriptive research designs;
- able to analyze the limitations of descriptive research designs

**Essential Readings**

- Creswell, W.J. and Creswell, J. D. (2018). Research Design: Qualitative, Quantitative and Mixed Methods. Sage Publications.
- Best, J. and Kahn, J. (2012). Research in Education (10<sup>th</sup> Edition). PHI learning Private Limited.

**Suggestive Readings**

- Boudah, D. J. (2010). Conducting Educational Research: Guide to Completing a Major Project. Sage Publication.
- Cohen, L. and Manion, L. (2002). Research Methods in Education (7<sup>th</sup> Edition). Routledge.

**Semester IV**

**Elective course**

**MME546EC: Innovation Project: Research Dissertation**

**Number of credits: 4**

**Marks: 100**

Each student will take up a research problem from the field of Education/ Mathematics Education and will carry out small scale research using appropriate research methodology under the guidance of a supervisor and finally write a detailed research report.

**\*List of the papers offered by AJKMCRC, Jamia Millia Islamia**

1. English for media communication
2. Advertising
3. Contemporary India and the world we live in
4. Development Journalism
5. Media Management
6. Public Relations and Corporate Communication
7. Media Laws and Ethics
8. Mass Communication Theory
9. Media Research
10. Advanced Gaming and Animation Scripting
11. The Science of Screenplay Writing & Production
12. Advertising Communication: Process & Planning
13. Street Theatre
14. Puppetry
15. Gaming and Animation Scripting
16. Introduction to South Indian Cinema
17. Basic Gaming
18. Social Media for Development Communication
19. Film Appreciation
20. Intensive English Communication
21. Introduction to Radio
22. MOOC and E-Learning