Sr. No: 4086 Roll. No: ____________

B.Sc. (Hons.) Mathematics - 2nd Semester examination, May-2016

Subject- Number Theory and Trigonometry (Paper code - 09050201)

Time: 3 Hours **Maximum Marks-75**

Instruction:

4. **Candidate should ensure that they have been provided with correct question paper. Complaints in this regard, if any, should be reported to the invigilator on duty in the examination hall within 15 minutes of the commencement of the exams. No compulsory shall be entertained thereafter.**
5. **Attempt five questions in all. Question No. 1 is compulsory. Attempt remaining four questions out of unit II TO IV, selecting one question from each unit.**
6. **All question carry marks as noted against each question.**

Q1. Answer all the following questions.

(a) Define congruence with example. **(3)**

(b) Write the statement of Wilson's theorem. **(3)**

(c) Define Greatest common divisor with example. **(3)**

(d) Find the *l.c.m* of 306 and 657. **(3)**

(e) Find the order of 2 (mod 385). **(3)**

UNIT- I

Q2. (a) If a, m, n are non zero int egers, then (a,mn) = 1 if andonly if (a,m) = 1 and (a,n) = 1. **(8)**

(b) The Product of two positive int egers is equal to the product of their L.C.M and G.C.D. **(7)**

OR

Q3. (a) Find the highest power of 6 contained in 500! **(8)**

(b) Solve the congruence 15x = 12(mod 21). **(7)**

UNIT - II

Q4. If p is an odd prime, them show that.

(i) $2^2.4^2.6^2 ....(p-1)^2 = (-1)^{\frac{p+1}{2}} \pmod p$ **(8)**

(ii) $1^2.3^2 ....(p-2)^2 = (-1)^{\frac{p+1}{2}} \pmod p$ **(7)**

OR

Q5. State and prove Chinese Remainder theorem. **(15)**

UNIT - III

Q6. (a) If α, β *be the roots of* $x^2 - 2x + 4 = 0$. *Prove that* $\alpha^n + \beta^n = 2^{n+1} \cos\frac{n\pi}{3}$ **(8)**

(b) Find all the values of $\left(\frac{1}{2} + \frac{i\sqrt{3}}{2}\right)^{\frac{3}{4}}$ and show that the continued product of all the values is 1. **(7)**

OR

Q7. (i) Express the following in terms of cos ines of multiples of θ. **(8)**

(a) $\text{Cos}^6\,\theta$ **(b)** $\text{Cos}^7\,\theta$

(ii) Prove that: $16 \sin^5\theta = sin5\theta - 5sin3\theta + 10sin\theta$. **(7)**

UINT-IV

Q8. (i) Find the sum to infinity of the series **(8)**

$$1-\frac{1}{2}cos\theta+\frac{1.3}{2.4}cos2\theta-\frac{1.3.5}{2.4.6}cos3\theta+\ \dots\dots;-\pi<\theta<\pi.$$

(ii) Sum the series: $\cos\theta-\frac{1}{2}cos2\theta+\frac{1}{3}cos3\theta-\dots\dots\dots.\infty.$ **(7)**

OR

Q9. Write the help of Gregory's series, prove that. **(8)**

(i) Prove that $\frac{\pi}{4}=\left(\frac{2}{3}+\frac{1}{7}\right)-\frac{1}{3}\left(\frac{2}{3^3}+\frac{1}{7^3}\right)+\frac{1}{5}\left(\frac{2}{3^5}+\frac{1}{7^5}\right)-\ \dots\dots\dots.\infty.$

(ii) $\frac{\pi}{2\sqrt{3}}=1-\frac{1}{3^2}+\frac{1}{5.3^2}-\frac{1}{7.3^3}+\dots\dots\dots.\infty.$ **(7)**

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Serial No. 4087 Roll No.____________

B.Sc. (Hons.)Mathematics – 2nd SEMESTER EXAMINATION MAY 2016
Ordinary Differential Equations; PAPER CODE: 09050202

Time: 03 Hours **Max. Marks: 75**

Instructions:

1. Write your Roll No. on the Question Paper.
2. Candidate should ensure that they have been provided the correct question paper. Complaint(s) in this regards, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt any **five** questions in all. Question No. **1** is compulsory. Attempt other four questions selecting one from each section.
4. All questions carry equal marks.

Q1. (a) Solve DE: $x^2 y''(x) - 4x\, y'(x) + 6y(x) = 0$ [3]

(b) Integrate the equation [3]

$$\frac{dx}{dt} - 2t = 0, \quad \frac{dy}{dt} - x + t^2 = 0$$

(c) Give an example (one each)and also justify the ODEs: linear, semilinear and quasilinear. [3]

(d) Show that the wronokian of any equation of ODES: satisfy the identity $w[y_1, y_2] = wo.\exp[-\int_{x0}^{x} p(t)dt]$ for DE $y'' + P(x)y' + Q(x)y = 0$. [3]

(e) What do you understand by the method of variation of parameters and give only its importance in solving an ODESO? [3]

Section - 1

Q2. (a) If one particular solution of Riecati equation is known, then its general solution can be obtained by the quadratures. [7.5]

(b) Integrate DE: $y'(x) + 2e^x y(x) - y^2(x) = e^{2x} + e^x$ if the particular solution $y_1(x) = e^x$ is known. [7.5]

OR

Q3. (a) Explain Lagrange equation $y(x) = xp(x) + g(p)$ and its importance integrate the DE: $y = x + p^2 - \left(\frac{2}{3}\right)p^3$. [7.5]

(b) Integrate claimant equation: (i) $y = p.x + \frac{a}{p}$ and (ii) $tp^3 - yp^2 + 1 = 0$ where $p = \frac{dy}{dt}$. [7.5]

Section – 2

Q4. (a) Snow that the on parameter family of curves $y^2 = 4c\,(c + x)$ are self – orthogonal. [7.5]

(b)Reduce that DE: $y'' - \frac{2}{x}y' + (n^2 + \frac{2}{x^2})y = 0$ to normal form and hence obtain its general solution [7.5]

OR

Q5. (a) Solve the I.V.P : $x^2y'' - 3xy' + 4y = 0;\ y(1) = 2, y'(1) = 8.$ [5]

(b) The change of variable $y(x) = u(x).\exp\left[-\frac{1}{2}\int^{x} P(z)dz\right]$ transforms [10]

ODE: $y'' + P(x)y' + Q(x)y = 0$ into DE $u''(x) + K(x)u(x) = 0$ where

$K(x) = [Q(x) - \frac{1}{4}p^2(x) - \frac{1}{2}p'(x)]$

Section – 3

Q6. (a) Obtain the general solution of DE: $(x-1)y'' - xy' + y = 0$ where $y_1(x) = x$ is a given solution. [7.5]

(b) Solve the DE: $(D^2 - 3D + 4)y = 4x^3.$ [7.5]

OR

Q7. (a) Find the solution of DE: $y'' + y = x^2$ by any method known to you. [7.5]

(b) Obtain the condition under which the given DE: [7.5]

$L[y] \equiv a_0(x)y'' + a_1(x)y'(x) + a_2(x)y(x) = 0$ is an exact equation.

Solve the DE: $y.y'' + y'^2 + 2x = 0$

Section – 4

Q8. (a) If $r = (x,y,z)$ and $\vec{X} = (P,Q,R)$ and since P,Q,R are differentiable and $\vec{X}$ represents a continuous vector filed then show that the condition of integrabiliting is $\vec{X}$ curl $\vec{X} = 0$. [10]

(b) Integrate the DE: $(y^2 + yz)dx + (z^2 + zx)dy + (y^2 - yx)dz = 0.$ [5]

OR

Q9. (a) Find the integral curves of DE : $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$ [7.5]

(b) Solve the simultaneous equations; [7.5]

$$\frac{dx}{dt} + 7x - y = 0$$

$$\frac{dy}{dt} + 2x + 5y = 0$$

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Sr. No. 4088 Roll No. ____________

B.SC. (HONS.) MATHEMATICS–2ND SEMESTER EXAMINATION, MAY- 2016

[VECTOR CALCULUS; PAPER CODE: 09050203]

Time: 03:00 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-9 is compulsory. Attempt remaining four questions selecting one from each Unit.
4. Draw diagram wherever required.

UNIT-I

1. (a) A particle moves on the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$, where t is the time. Find the components of velocity and acceleration at time $t=1$ in the direction of $\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$. (8)

   (b) Show that the vectors 4i+5j+k, -j-k, 3i+9j+4k and 4(-i+j+k) are coplanar. (7)

2. (a) Find the directional derivative of $\phi = (x^2 + y^2 + z^2)^{-1/2}$ at the point P(3, 1, 2) in the direction of the vector $yz\hat{\imath} + xz\hat{\jmath} + xy\hat{k}$. (8)

   (b) If **a, b** are constant vectors, and ω is a constant, and **r** is a vector function of the scalar variable t given by $\mathbf{r} = \cos \omega t\, \mathbf{a} + \sin \omega t\, \mathbf{b}$, (7)

   Show that $\frac{d^2\boldsymbol{r}}{dt^2} + \omega^2 \boldsymbol{r} = \mathbf{0}$ and $\boldsymbol{r} \times \frac{d\boldsymbol{r}}{dt} = \omega \boldsymbol{a} \times \boldsymbol{b}$

UNIT-II

3. (a) A rigid body is rotating with angular velocity ω about a fixed axis, then prove that the curl of linear velocity V is two times the angular velocity ω. (8)

   (b) If $u = x + y + z$, $v = x^2 + y^2 + z^2$, $w = yz + zx + xy$ prove that grad u, grad v and grad w are coplanar vectors. (7)

4. (a) In what direction the directional derivative of $\emptyset = x^2y^2z$ from (1, 1, 2) will be maximum and what is its magnitude? Also find a unit normal vector to the surface $x^2y^2z = 2$ at the point (1, 1, 2). (8)

   (b) Prove that $\nabla^2\left(\frac{1}{r}\right) = 0$ or div $(\text{grad}\frac{1}{r}) = 0$ where $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$. (7)

UNIT-III

5. (a) Prove that a spherical coordinate system is orthogonal. (7)

   (b) Show that the vector field $\bar{A}$ in spherical coordinates where $\bar{A} = \frac{2\cos\theta}{r^3}\bar{e_r} + \frac{\sin\theta}{r^3}\overline{e_\theta}$ is solenoidal. (8)

6. (a) Prove that curl of gradient f=0 in any orthogonal curvilinear coordinate system. (7)

   (b) Compute the curl of $\bar{A}$ specified in cylindrical coordinates where $\bar{A} = \sin\theta\, \bar{e_\rho} + \frac{\cos\theta}{\rho}\overline{e_\theta} - \rho z\bar{e}_z$. (8)

UNIT-IV

7. (a) If $\vec{F} = 3xy\,\hat{\imath} - y^2\hat{\jmath}$, evaluate $\int_C \vec{F}.d\vec{r}$ where C is the curve in the xy- plane, $y=2x^2$, from (0, 0) to (1, 2). (8)

   (b) State and prove Green's theorem. (7)

8. (a) State and prove Stoke's theorem. (7)

   (b) By using Gauss divergence theorem, evaluate $\iint_S \left(x\hat{\imath} + y\hat{\jmath} + z^2\hat{k}\right).\hat{n}dS$ where S is the closed surface bounded by the cone $x^2 + y^2 = z^2$ and the plane z=1. (8)

UNIT-V

9. Attempt all parts. (each part carries **2.5marks**.) (15)

   (a) If $r = |\vec{r}|$ $where$ $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, prove that $\nabla r = \frac{1}{r}\vec{r}$.

   (b) Prove that $\nabla\emptyset.d\vec{r} = d\emptyset$.

   (c) State Gauss Divergence Theorem.

   (d) Define Divergence of a vector point function and condition for a solenoidal vector.

   (e) If $\vec{F} = x^2y\hat{\imath} + xz\hat{\jmath} + 2yz\hat{k}$ find the value of $iv\ curl\,\overrightarrow{F}$.

   (f) Find the volume element dV in cylindrical coordinates.

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Sr. No. 4089 Roll No. ______________

B.SC. (HONS.) MATHEMATICS–2^{ND} SEMESTER EXAMINATION, MAY- 2016

[DISCRETE MATHEMATICS-II; PAPER CODE: 09050204]

Time: 03:00 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-9 is compulsory. Attempt remaining four questions selecting one from each Unit.
4. Draw diagram wherever required.

UNIT-I

1. (a) Let $(L, \leq)$ be a lattice and $a, b \in L$ such that $a\leq b\leq c$, then prove that
   (i) $a \vee b = b \wedge c$, and (4)
   (ii) $(a \wedge b) \vee (b \wedge c) = (a \vee b) \wedge (a \vee c)$. (4)
   (b) Prove that two definitions of Lattice are equivalent to one another. (7)

2. (a) Let L be a lattice the prove that
   (i) $a \vee (b \vee a) = a$ (4)
   (ii) $a \vee (b \vee c) = (a \vee b) \vee c$. (4)
   (b) Prove that a lattice L is modular if and only if-
   $a \wedge (b \vee (a \wedge c)) = (a \wedge b) \vee (a \wedge c)$ for all $a, b, c \in L$. (7)

UNIT-II

3. (a) Let 'a' be any element of a Boolean Algebra B. Then prove that: (5)
   (i) Complement of a is unique
   (ii) Involution Law
   (iii) $0' = 1$ and $1' = 0$.
   (b) Which of the following are Boolean algebras and which are not ? Explain your reasoning also:
   (i) D_{50} (ii) D_{42} (iii) D_{66} (iv) D_{110} (v) D_{20} (10)

4. (a) Express $E = z(x'+y) + y'$ in complete sum of products form. (7)
   (b) If f, f_1 and f_2 are the functions from $B_n \to B$ and the set $S(f) = \{b \in B_n : f(b) = 1\}$ then prove that if $S(f) = S(f_1) \cup S(f_2)$, then $f(b) = f_1(b) \vee f_2(b)$. (8)

UNIT-III

5. (a) If G is a connected graph and every vertex has even degree then prove that G has an Euler circuit. (8)
   (b) Prove that a non-trivial simple graph G must have at least one pair of vertices whose degrees are equal. (7)

6. (a) Show that a simple planar graph with less than 30 edges has a vertex of degree 4 or less. (6)
   (b) If G is a graph with 1000 vertices and 3000 edges, what can you conclude about G is planar? (4)
   (c) Define Hamiltonian cycle in a graph. Give an example of a graph that has an Euler cycle and Hamiltonian cycle that are not identical. (5)

UNIT-IV

7. (a) Prove that every connected graph has at least one spanning tree. (8)
   (b) If T is full binary tree with i external vertices, then prove that T has i+1 terminal vertices and 2i+1 total vertices. (7)

8. (a) Construct labelled tree for the algebraic expressions : (6)
   (i) (x +(y –(x+y))) x ((3 / (2 x 7))x4)
   (ii) ((2+x)-(2 x x))- (x-2)
   (b) Draw the ordered rooted tree for the following prefix expressions. (9)
   (i) */93+*24-76
   (ii) +-↑ 32↑23/6-42
   What is the value of each of these expressions? Write the infix expressions for each of the expressions?

UNIT-V

9. All questions are compulsory. (5X3=15)
   a) Prove that $\sum_{i=1}^{n} d(v_i) = 2e$ in a graph with n vertices v_i and e edges.
   b) Prove that the number of vertices n in a binary tree is always odd.
   c) Define complemented Lattice.
   d) Define consensus of fundamental products.
   e) Define Complete Bipartite Graph with example.

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Sr. No. 4090 Roll No. ______________

B.SC. (HONS.) MATHEMATICS–2ND SEMESTER EXAMINATION, MAY- 2016

[REGRESSION ANALYSIS AND PROBABILITY; PAPER CODE: 09050205]

Time: 03:00 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-1 is compulsory. Attempt remaining four questions selecting one from each Unit.
4. Draw diagram wherever required.

1. Answer all the following questions. (5x3=15)
   (a) Write normal equations for fitting of a second degree parabola.
   (b) Define correlation.
   (c) Write classical definition of probability.
   (d) Define probability density function.
   (e) Define conditional distributions.

UNIT-I

2. (i) Prove that the angle between two lines of regression is $\tan\theta = \frac{1-r^2}{r}\frac{\sigma_x\sigma_y}{\sigma^2_x+\sigma_y^2}$ (8)

   (ii) Calculate linear regression coefficients from the following: (7)

x	1	2	3	4	5	6	7	8
y	3	7	10	12	14	17	20	24

3. (i) Fit a second degree parabola to the following data: (8)

x	1	2	3	4
y	6	11	18	27

   (ii) Find the Normal equations of the curve $y = ax^b$ by curve fitting method. (7)

UNIT-II

4. (i) A card is drawn from an ordinary pack and a gambler bets that it is a spade or an ace. What is the probability of the gambler`s winning the bet. (8)

   (ii) What is the probability of throwing a total of 15 from the toss of three ordinary dice together? (7)

5. (i) If two dice are thrown, what is the probability is neither 7 nor 11. (5)

   (ii) From pack of 52 cards two are drawn at random .Find the probability that one is a king and the other is queen. (5)

   (iii)Given P (A)= ¼, P (B) = 1/3 and P (A U B)= ½, evaluate P (A/B). (5)

UNIT-III

6. (i) A random variable X has the following probability function: (8)

(Values of X), x	0	1	2	3	4	5	6	7
p(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

(a) Find k (b) Evaluate $P(X < 6)$, $P(X \geq 6)$, $P(3 < X \leq 6)$

(ii) Five defective bulbs are accidentally mixed with twenty good ones. It is not possible to just look at a bulb and tell whether or not it is defective. Find the probability distribution of the number of defective bulbs, if four bulbs are drawn at random from this lot. (7)

7. (i) Out of 800 families with 5 children each, how many would you expect to have (a) 3 boys (b) 5 girls (c) either 2 or 3 boys? Assume equal probabilities for boys and girls. (8)

(ii) What is the chance that a leap year selected at random will contain 53 Sundays? (7)

UNIT-IV

8. (i) Define skewness and its types with the help of graph also write coefficient of skewness. (8)

(ii) The following table represents the height of a batch of 100 students. Calculate kurtosis: (7)

Height(cm)	59	61	63	65	67	69	71	73	75
No. of students	0	2	6	20	40	20	8	2	2

9. (i) The first four moments of a distribution about the value '4' of the variable are -1.5, 17, -30 and 108. State whether the distribution is leptokurtic or platykurtic. (8)

(ii) Define Kurtosis and its types by graph and write coefficient of kurtosis. (7)

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Sr. No: 4091

Roll No: ____________

B.SC. (HONS.) MATHEMATICS - 2nd SEMESTER EXAMINATION, MAY-2016

SUBJECT- PROGRAMMING IN VISUAL BASIC (PAPER CODE - 09050207)

Time: 3 Hours **Maximum Marks-75**

Instruction:

1. **Write your Roll No. on the question paper.**
2. **Candidate should ensure that they have been provided with correct question paper. Complaint(s) in this regard, if any, should be reported to the invigilator on duty in the examination hall within 15 minutes of the commencement of the exams. No complaint(s) in this regard will be entertained thereafter.**
3. **Attempt five questions in all. Question No. 1 is compulsory. Attempt other four questions selecting one from each unit.**
4. **All question carry equal marks.**

Q1. Answer all the following questions: **(5x3=15)**

(a) What is explicit and implicit variable declaration in Visual Basic?

(b) Explain Active X controls.

(c) What is the use of EXIT statement?

(d) How does Visual basic handles Database Programming?

(e) Explain the purpose of toolbar in Visual Basic.

UNIT-I

Q2. (a) Explain various types of selection statements used in Visual basic with examples. **(8)**

(b) What do you understand by Event Driven Programming? Explain its advantages and disadvantages. **(7)**

OR

Q3. (a) What are Control Arrays? How they are created at Design time and Run time? **(7)**

(b) What are variables? How variables are declared in Visual basic? Explain the scope and lifetime of variables. **(8)**

UNIT-II

Q4. (a) Explain the various types of Controls used in Visual Basic. Also discuss the common properties of Controls. **(12)**

(b) Explain Timer Control in brief. **(3)**

OR

Q5. (a) Write short note on the following: **(5X3=15)**

(i) Hiding and showing forms

(ii) Adding multiple forms in VB

(iii) Load and Unload Statements in VB

UNIT-III

Q6. What are Menus? What are the various options of Menu Editor? Explain creating Menus and Sub Menus using examples. **(15)**

P.T.O

OR

Q7. Differentiate Functions and Procedures? What are the advantages of Procedures? Discuss various types of procedures available in Visual Basic with examples. **(15)**

UNIT-IV

Q8. What are Crystal Reports? How the Crystal Reports can be created in Visual basic? How can we take a print using crystal report? Explain **(15)**

OR

Q9. (a) Discuss the usage of Message Box and Input Box in VB Program. **(10)**

(b) How would you convert Strings from Numbers and Vice versa? **(5)**

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Sr. No. 4092 Roll No. ________________

B.SC. (HONS.) MATHEMATICS–2ND SEMESTER EXAMINATION, MAY- 2016

[ENVIRONMENTAL SCIENCES; PAPER CODE: 09050213]

Time: 03:00 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidate should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt five questions in all. Question no.-1 is compulsory. Attempt remaining four questions selecting one from each Unit.
4. Draw diagram wherever required.

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1. Write notes on:
   a) Population Explosion (2)
   b) Doubling Time (2)
   c) Total Fertility Rate (2)
   d) Noise Pollution (2)
   e) Global Warming (2)
   f) Floods (2)
   g) Earthquake (2)
   h) Water (Prevention and Control of Pollution) Act (1)

UNIT-I

2. Briefly discuss the major uses of forest. What are the main causes and consequences of deforestation? (15)

Or

3. Describe Biodiversity and its conservation strategies in detail. (15)

UNIT-II

4. Define 'Environment'. How would environmental awareness help to protect the environment? (15)

Or

5. Write Short notes on: (15)
   a) Sustainable Development
   b) Urban problem, related to energy

UNIT-III

6. What are the natural and man made pollutant that cause Air Pollution. Write in brief about effects and controlling techniques of Air Pollutant. (15)

Or

7. Classify Solid Waste. How we can manage different types of solid wastes? (15)

UNIT-IV

8. What are the biotic and abiotic components of ecosystem. Explain Food Chain and Food Web with suitable examples. (15)

Or

9. What is population explosion? What are the reasons behind population explosion and the control strategies? (15)

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