DATE:________________

A CONSOLIDATED QUESTION PAPER-CUM-ANSWER BOOKLET

IMS™
(INSTITUTE OF MATHEMATICAL SCIENCES)

PROBABLE / EXPECTED MODEL QUESTIONS *for* IAS Mathematics (Opt.) MAINS-2018

(JUNE-2018 *to* SEPT.-2018)

Under the guidance *of* K. Venkanna

MATHEMATICS

PAPER - 1 : FULL SYLLABUS

TEST CODE: TEST-13: IAS(M)/09-SEP.-2018

Time: Three Hours **Maximum Marks: 250**

INSTRUCTIONS

1. This question paper-cum-answer booklet has 50 pages and has 33PART/SUBPART questions. Please ensure that the copy of the question paper-cum-answer booklet you have received contains all the questions.
2. Write your Name, Roll Number, Name of the Test Centre and Medium in the appropriate space provided on the right side.
3. A consolidated Question Paper-cum-Answer Booklet, having space below each part/sub part of a question shall be provided to them for writing the answers. Candidates shall be required to attempt answer to the part/sub-part of a question strictly within the pre-defined space. Any attempt outside the pre-defined space shall not be evaluated. ''
4. Answer must be written in the medium specified in the admission Certificate issued to you, which must be stated clearly on the right side. No marks will be given for the answers written in a medium other than that specified in the Admission Certificate.
5. Candidates should attempt Question Nos. 1 and 5, which are compulsory, and any **THREE** of the remaining questions selecting at least **ONE** question from each Section.
6. The number of marks carried by each question is indicated at the end of the question. Assume suitable data if considered necessary and indicate the same clearly.
7. Symbols/notations carry their usual meanings, unless otherwise indicated.
8. All questions carry equal marks.
9. All answers must be written in blue/black ink only. Sketch pen, pencil or ink of any other colour should not be used.
10. All rough work should be done in the space provided and scored out finally.
11. The candidate should respect the instructions given by the invigilator.
12. The question paper-cum-answer booklet must be returned in its entirety to the invigilator before leaving the examination hall. Do not remove any page from this booklet.

READ INSTRUCTIONS ON THE LEFT SIDE OF THIS PAGE CAREFULLY

Name

Roll No.

Test Centre

Medium

Do not write your Roll Number or Name anywhere else in this Question Paper-cum-Answer Booklet.

I have read all the instructions and shall abide by them

Signature of the Candidate

I have verified the information filled by the candidate above

Signature of the invigilator

IMPORTANT NOTE:
Whenever a question is being attempted, all its parts/ sub-parts must be attempted contiguously. This means that before moving on to the next question to be attempted, candidates must finish attempting all parts/ sub-parts of the previous question attempted. This is to be strictly followed. Pages left blank in the answer-book are to be clearly struck out in ink. Any answers that follow pages left blank may not be given credit.

DO NOT WRITE ON THIS SPACE

INDEX TABLE

QUESTION	No.	PAGE NO.	MAX. MARKS	MARKS OBTAINED
1	(a)			
	(b)			
	(c)			
	(d)			
	(e)			
2	(a)			
	(b)			
	(c)			
	(d)			
3	(a)			
	(b)			
	(c)			
	(d)			
4	(a)			
	(b)			
	(c)			
	(d)			
5	(a)			
	(b)			
	(c)			
	(d)			
	(e)			
6	(a)			
	(b)			
	(c)			
	(d)			
7	(a)			
	(b)			
	(c)			
	(d)			
8	(a)			
	(b)			
	(c)			
	(d)			
			Total Marks	

DO NOT WRITE ON
THIS SPACE

SECTION – A

1. (a) Find a basis for a subspace U of V in the following

(i) $U = \left\{ (x_1, x_2, x_3, x_4, x_5) \in V_5 \,/\, \begin{matrix} x_1 + x_2 + x_3 = 0 \\ 3x_1 - x_4 + 7x_5 = 0 \end{matrix} \right\}, V = V_5$

(ii) U = $\{p \in \rho_4 / p(x_0) = 0\}$, V = ρ_4 , where ρ_4 is the set of all polynomials of degree ≤ 4. **[10]**

1. (b) Let T be the linear operator on $\mathbf{R}^3$ which is represented in the standard ordered basis by the matrix

$$A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 1 & -1 \\ 0 & 2 & 4 \end{bmatrix}.$$ Find the minimal polynomial for T. **[10]**

1. (c) If $V = \log_e \sin \left\{ \frac{\pi\left(2x^2 + y^2 + xz\right)^{1/2}}{2\left(x^2 + xy + 2yz + z^2\right)^{1/3}} \right\}$, find the value of

$x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y} + z\frac{\partial V}{\partial z}$ when x = 0, y = 1, z = 2. **[10]**

1. (d) Show that $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x + \cos x} dx = \frac{1}{\sqrt{(2)}} \log\left(\sqrt{2}+1\right)$ **[10]**

1. (e) The plane $lx + my = 0$ is rotated about its line of intersection with the plane $z = 0$ through an angle a. Prove that the equation of the plane in its new position is $lx + my \pm z\sqrt{l^2 + m^2}\tan\alpha = 0$. **[10]**

2. (a) (*i*) Verify that the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ satisfies its own characteristic equation. Is it true of every square matrix ? State the theorem that applies here.

(*ii*) Let $V = R^4 (R)$ and $W = \{(a, b, c, d) \in R^4 : a = b + c, c = b + d\}$. Find a basis and the dimension of W. **(20)**

2. (b) Compute f_{xy} (0, 0) and f_{yx} (0, 0) for the function

$$f(x, y) = \begin{cases} \dfrac{xy^3}{x+y^2}, (x,y) \neq (0,0) \\ 0, (x,y) = (0,0). \end{cases}$$

Also, discuss the continuity of f_{xy} and f_{yx} at (0,0) **[15]**

2. (c) Prove that the enveloping cylinder of the ellipsoid $(x^2/a^2) + (y^2/b^2) + (z^2/c^2) = 1$ whose generators are parallel to the line $\frac{x}{0} = \frac{y}{\pm\sqrt{(a^2 - b^2)}} = \frac{z}{c}$ meet the plane $z = 0$ in circles. **[15]**

3. (a) Let T be the linear operator on R^4 which is represented in the standard ordered basis by the matrix

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ a & 0 & 0 & 0 \\ 0 & b & 0 & 0 \\ 0 & 0 & c & 0 \end{bmatrix}$$

Under what conditions on a,b, and c is T diagonalizable? **[15]**

3. (b) Obtain the volume bounded by the elliptic paraboloids given by the equations $z = x^2 + 9y^2$ and $z = 18 - x^2 - 9y^2$. **[15]**

3. (c) Prove that the shortest distance between generatorsof the same system drawn at the ends of diameters of the principal elliptic section of the hyperboloid $(x^2/a^2) + (y^2/b^2) - (z^2/c^2) = 1$ lie on the surfaces whose equations are $\frac{cxy}{x^2+y^2} = \pm\frac{abz}{a^2-b^2}$. **[20]**

4. (a) Find the condition on a, b, and c so that the following system in unknowns x, y and z has a solution.

$x + 2y - 3z = a,\ 2x + 6y - 11z = b,\ x - 2y + 7z = c$ **[10]**

4. (b) Find an upper triangular matrix A such that

$$A^3 = \begin{bmatrix} 8 & -57 \\ 0 & 27 \end{bmatrix}$$ **[08]**

4. (c) (i) Show that the set

$S = \left\{ 1 + \frac{(-1)^n}{2^n} : n \text{ is a positive integer} \right\} \text{is bounded}.$ Show that 1 is a limit point of S.

Are there any other limit points of S ?

(ii) Given w = (x, y) with x = u + v, y = u – v, show that

$$\frac{\partial^2 w}{\partial u \partial v} = \frac{\partial^2 w}{\partial x^2} - \frac{\partial^2 w}{\partial y^2}.$$

[16]

4. (d) Two perpendicular tangent planes to the paraboloid $(x^2/a) + (y^2/b) = 2z$ intersect in a line lying on the plane $x = 0$. Prove that the line touches the parabola $x = 0$, $y^2 = (a + b)(2z + a)$. **[16]**

SECTION – B

5. (a) Find the orthogonal trajectories of family of curves $r^2 = a^2 \cos 2\theta$ **[10]**

5. (b) Four uniform rods are freely jointed at their extremities and form a parallelogram *ABCD*, which is suspended by the joint *A*, and is kept in shape by a string *AC*. Prove that the tension of the string is equal to half the weight of all the four rods. **[10]**

5. (c) A projectile aimed at a mark which is in a horizontal plane through the point of projection, falls a metres short of it when the elevation is a and goes *b* metres too far when the elevation is b. Show that, if the velocity of projection be the same in all cases, the proper elevation is $\frac{1}{2}\sin^{-1}\frac{a\sin 2\beta+b\sin 2\alpha}{a+b}$ **[10]**

5. (d) Verify Stoke's theorem for $\mathbf{F} = -y^3\,\mathbf{i} + x^3\mathbf{j}$, where S is the circular disc $x^2 + y^2 \leq \mathbf{1}$, $z = 0$. **[10]**

5. (e) Given the space curve $x = t$, $y = t^2$ $z = \frac{2}{3}t^3$, find (*i*) the curvature κ. (*ii*) the torsion τ. **[10]**

6. (a) Solve $(x^2 - 4)p^2 - 2xyp - x^2 = 0$ and examine for singular solutions and extraneous loci. **[10]**

6. (b) Apply the method of variation of parameters to solve $x^2y_2 + 3xy_1 + y = 1/(1 - x)^2$. **[10]**

6. (c) A uniform rod AB of length 2a movable about a hinge at A rests with other end against a smooth vertical wall. If α is the inclination of the rod to the vertical, prove that the magnitude of reaction of the hinge is

$$\frac{1}{2}W\sqrt{4+\tan^2\alpha}$$

where W is the weight of the rod. **[16]**

6. (d) (i) What is the directional derivative of $\phi = xy^2 + yz^3$ at the point (2, −1, 1) in the direction of the normal to the surface x log z −y^2 = −4 at (−1, 2, 1) ?

(ii) For a solenoidal vector F, show that curl curl curl curl $F = \nabla^4 F$ **[14]**

7. (a) Solve $\left(D^4 + D^2 + 1\right)y = e^{-x/2}\cos\left(x\sqrt{3}/2\right)$. **[13]**

7. (b) Solve $x(1 - x^2)\ dy + (2x^2\ y - y - ax^3)dx = 0$ **[06]**

7. (c) A particle moves under a force

$m\mu \{3au^4 - 2(a^2 - b^2) u^5\}$, $a > b$

and is projected from an apse at a distance $(a + b)$ with velocity $\sqrt{\mu}/(a + b)$. Show that the equation of its path is $r = a + b \cos \theta$. **[15]**

7. (d) (i) Show that $r^n \mathbf{r}$ is an irrotational vector for any value of n, but is solenoidal only if n = – 3($\mathbf{r}$ is position vector of a point).

(ii) Find the value of a, b and c such that

$$F = (3x - 4y + az)\hat{i} + (cx + 5y - 2z)\hat{j} + (x - by + 7z)\hat{k}$$

is irrotational. **[10+6=16]**

8. (a) By using Laplace transform method, solve

$(D^2 + m^2)\,x = a \cos nt,\ t > 0$ if $x = Dx = 0$ when $t = 0$ **[14]**

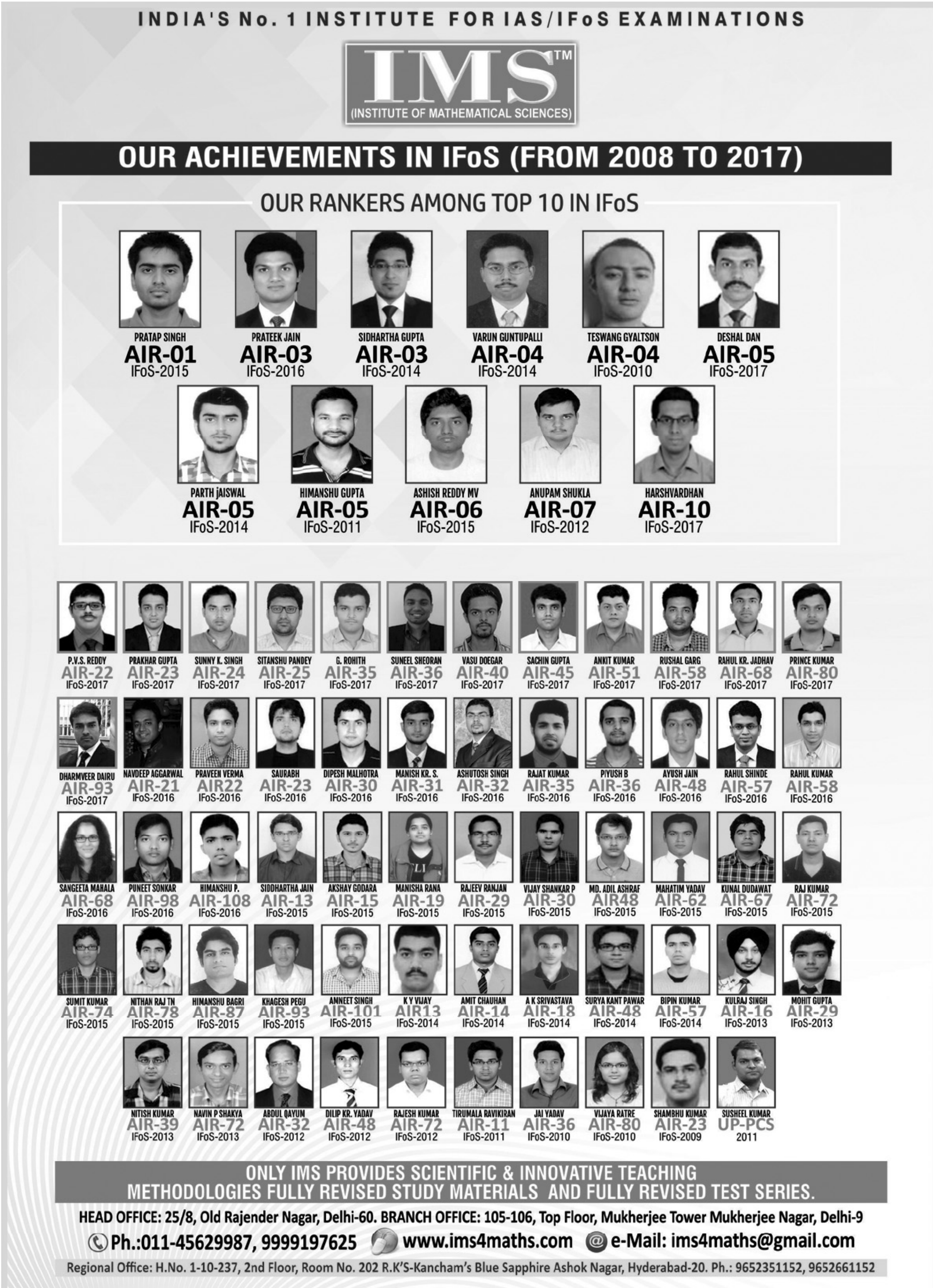
8. (b) A particle slides down the arc of a smooth cycloid whose axis is vertical and vertex lowest, starting at rest from the cusp. Prove that the time occupied in falling down the first half of the vertical height is equal to the time of falling down the second half.

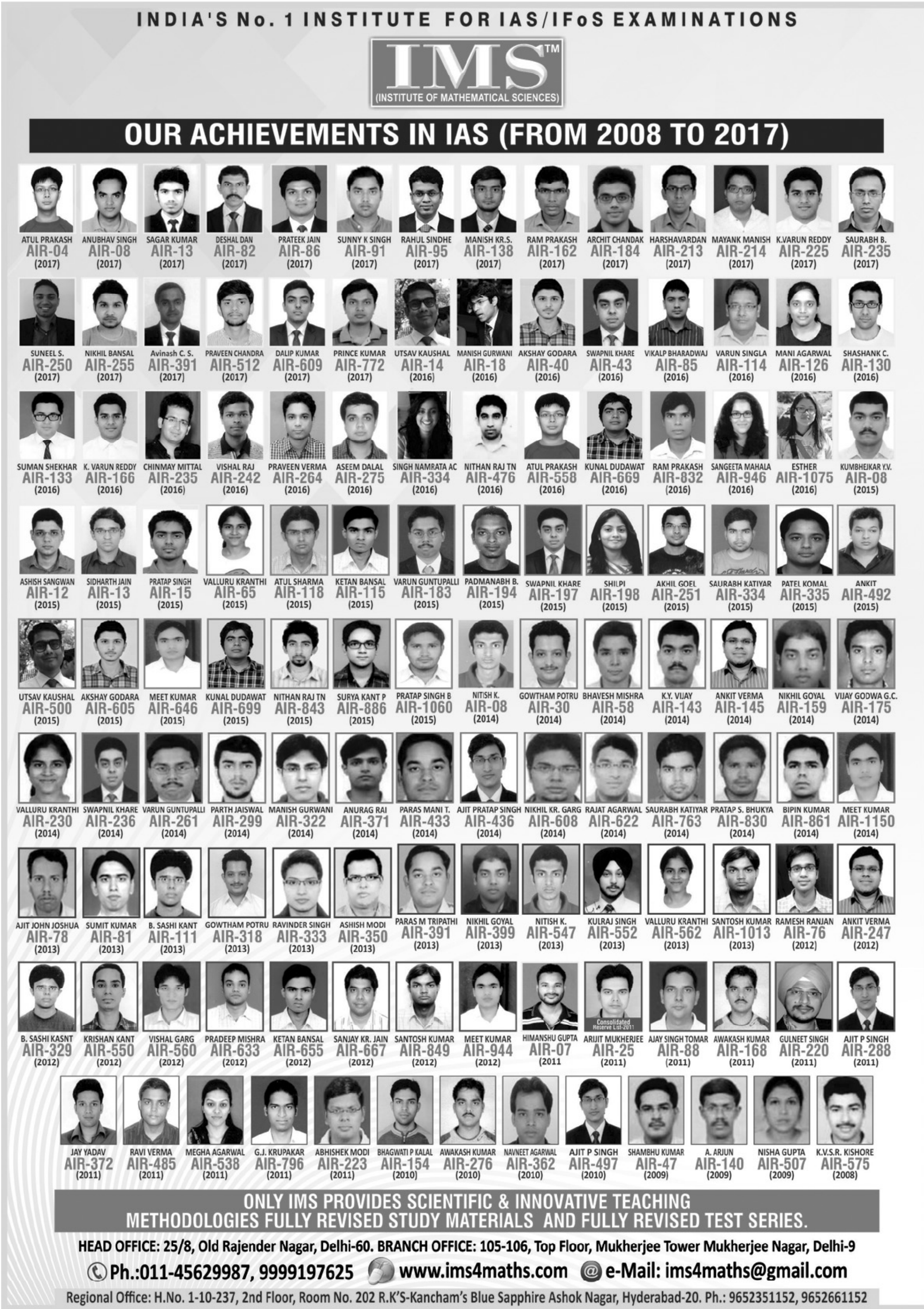
[13]

8. (c) A particle moves along the curve x = 4 cos t, y = 4 sin t, z = 6t. Find the velocity and acceleration at time t = 0 and $t=\frac{1}{2}\pi$. Find also the magnitudes of the velocity and acceleration at any time t. **[08]**

8. (d) If $A = 2yz\mathbf{i} - (x + 2y - 2)\mathbf{j} + (x^2 + z)\mathbf{k}$, evaluate $\iint_s (\nabla \times A).\text{n}dS$ over the surface of intersection of the cylinders $x^2 + y^2 = a^2$, $x^2 + z^2 = a^2$ which is included in the first octant. **[15]**

ROUGH SPACE


INDIA'S No. 1 INSTITUTE FOR IAS/IFoS EXAMINATIONS
IMS™
(INSTITUTE OF MATHEMATICAL SCIENCES)
OUR ACHIEVEMENTS IN IFoS (FROM 2008 TO 2017)
OUR RANKERS AMONG TOP 10 IN IFoS
PRATAP SINGH AIR-01 IFoS-2015
PRATEEK JAIN AIR-03 IFoS-2016
SIDHARTHA GUPTA AIR-03 IFoS-2014
VARUN GUNTUPALLI AIR-04 IFoS-2014
TESWANG GYALTSON AIR-04 IFoS-2010
DESHAL DAN AIR-05 IFoS-2017
PARTH jAISWAL AIR-05 IFoS-2014
HIMANSHU GUPTA AIR-05 IFoS-2011
ASHISH REDDY MV AIR-06 IFoS-2015
ANUPAM SHUKLA AIR-07 IFoS-2012
HARSHVARDHAN AIR-10 IFoS-2017
P.V.S. REDDY AIR-22 IFoS-2017
PRAKHAR GUPTA AIR-23 IFoS-2017
SUNNY K. SINGH AIR-24 IFoS-2017
SITANSHU PANDEY AIR-25 IFoS-2017
G. ROHITH AIR-35 IFoS-2017
SUNEEL SHEORAN AIR-36 IFoS-2017
VASU DOEGAR AIR-40 IFoS-2017
SACHIN GUPTA AIR-45 IFoS-2017
ANKIT KUMAR AIR-51 IFoS-2017
RUSHAL GARG AIR-58 IFoS-2017
RAHUL KR. JADHAV AIR-68 IFoS-2017
PRINCE KUMAR AIR-80 IFoS-2017
DHARMVEER DAIRU AIR-93 IFoS-2017
NAVDEEP AGGARWAL AIR-21 IFoS-2016
PRAVEEN VERMA AIR22 IFoS-2016
SAURABH AIR-23 IFoS-2016
DIPESH MALHOTRA AIR-30 IFoS-2016
MANISH KR. S. AIR-31 IFoS-2016
ASHUTOSH SINGH AIR-32 IFoS-2016
RAJAT KUMAR AIR-35 IFoS-2016
PIYUSH B AIR-36 IFoS-2016
AYUSH JAIN AIR-48 IFoS-2016
RAHUL SHINDE AIR-57 IFoS-2016
RAHUL KUMAR AIR-58 IFoS-2016
SANGEETA MAHALA AIR-68 IFoS-2016
PUNEET SONKAR AIR-98 IFoS-2016
HIMANSHU P. AIR-108 IFoS-2016
SIDDHARTHA JAIN AIR-13 IFoS-2015
AKSHAY GODARA AIR-15 IFoS-2015
MANISHA RANA AIR-19 IFoS-2015
RAJEEV RANJAN AIR-29 IFoS-2015
VIJAY SHANKAR P AIR-30 IFoS-2015
MD. ADIL ASHRAF AIR48 IFoS-2015
MAHATIM YADAV AIR-62 IFoS-2015
KUNAL DUDAWAT AIR-67 IFoS-2015
RAJ KUMAR AIR-72 IFoS-2015
SUMIT KUMAR AIR-74 IFoS-2015
NITHAN RAJ TN AIR-78 IFoS-2015
HIMANSHU BAGRI AIR-87 IFoS-2015
KHAGESH PEGU AIR-93 IFoS-2015
ANNEET SINGH AIR-101 IFoS-2015
K Y VIJAY AIR13 IFoS-2014
AMIT CHAUHAN AIR-14 IFoS-2014
A K SRIVASTAVA AIR-18 IFoS-2014
SURYA KANT PAWAR AIR-48 IFoS-2014
BIPIN KUMAR AIR-57 IFoS-2014
KULRAJ SINGH AIR-16 IFoS-2013
MOHIT GUPTA AIR-29 IFoS-2013
NITISH KUMAR AIR-39 IFoS-2013
NAVIN P SHAKYA AIR-72 IFoS-2013
ABDUL QAYUM AIR-32 IFoS-2012
DILIP KR. YADAV AIR-48 IFoS-2012
RAJESH KUMAR AIR-72 IFoS-2012
TIRUMALA RAVIKIRAN AIR-11 IFoS-2011
JAI YADAV AIR-36 IFoS-2010
VIJAYA RATRE AIR-80 IFoS-2010
SHAMBHU KUMAR AIR-23 IFoS-2009
SUSHEEL KUMAR UP-PCS 2011
ONLY IMS PROVIDES SCIENTIFIC & INNOVATIVE TEACHING
METHODOLOGIES FULLY REVISED STUDY MATERIALS AND FULLY REVISED TEST SERIES.
HEAD OFFICE: 25/8, Old Rajender Nagar, Delhi-60. BRANCH OFFICE: 105-106, Top Floor, Mukherjee Tower Mukherjee Nagar, Delhi-9
Ph.:011-45629987, 9999197625 www.ims4maths.com e-Mail: ims4maths@gmail.com
Regional Office: H.No. 1-10-237, 2nd Floor, Room No. 202 R.K'S-Kancham's Blue Sapphire Ashok Nagar, Hyderabad-20. Ph.: 9652351152, 9652661152


INDIA'S No. 1 INSTITUTE FOR IAS/IFoS EXAMINATIONS
IMS™
(INSTITUTE OF MATHEMATICAL SCIENCES)
OUR ACHIEVEMENTS IN IAS (FROM 2008 TO 2017)
ATUL PRAKASH AIR-04 (2017)
ANUBHAV SINGH AIR-08 (2017)
SAGAR KUMAR AIR-13 (2017)
DESHAL DAN AIR-82 (2017)
PRATEEK JAIN AIR-86 (2017)
SUNNY K SINGH AIR-91 (2017)
RAHUL SINDHE AIR-95 (2017)
MANISH KR.S. AIR-138 (2017)
RAM PRAKASH AIR-162 (2017)
ARCHIT CHANDAK AIR-184 (2017)
HARSHAVARDAN AIR-213 (2017)
MAYANK MANISH AIR-214 (2017)
K.VARUN REDDY AIR-225 (2017)
SAURABH B. AIR-235 (2017)
SUNEEL S. AIR-250 (2017)
NIKHIL BANSAL AIR-255 (2017)
Avinash C. S. AIR-391 (2017)
PRAVEEN CHANDRA AIR-512 (2017)
DALIP KUMAR AIR-609 (2017)
PRINCE KUMAR AIR-772 (2017)
UTSAV KAUSHAL AIR-14 (2016)
MANISH GURWANI AIR-18 (2016)
AKSHAY GODARA AIR-40 (2016)
SWAPNIL KHARE AIR-43 (2016)
VIKALP BHARADWAJ AIR-85 (2016)
VARUN SINGLA AIR-114 (2016)
MANI AGARWAL AIR-126 (2016)
SHASHANK C. AIR-130 (2016)
SUMAN SHEKHAR AIR-133 (2016)
K. VARUN REDDY AIR-166 (2016)
CHINMAY MITTAL AIR-235 (2016)
VISHAL RAJ AIR-242 (2016)
PRAVEEN VERMA AIR-264 (2016)
ASEEM DALAL AIR-275 (2016)
SINGH NAMRATA AC AIR-334 (2016)
NITHAN RAJ TN AIR-476 (2016)
ATUL PRAKASH AIR-558 (2016)
KUNAL DUDAWAT AIR-669 (2016)
RAM PRAKASH AIR-832 (2016)
SANGEETA MAHALA AIR-946 (2016)
ESTHER AIR-1075 (2016)
KUMBHEJKAR Y.V. AIR-08 (2015)
ASHISH SANGWAN AIR-12 (2015)
SIDHARTH JAIN AIR-13 (2015)
PRATAP SINGH AIR-15 (2015)
VALLURU KRANTHI AIR-65 (2015)
ATUL SHARMA AIR-118 (2015)
KETAN BANSAL AIR-115 (2015)
VARUN GUNTUPALLI AIR-183 (2015)
PADMANABH B. AIR-194 (2015)
SWAPNIL KHARE AIR-197 (2015)
SHILPI AIR-198 (2015)
AKHIL GOEL AIR-251 (2015)
SAURABH KATIYAR AIR-334 (2015)
PATEL KOMAL AIR-335 (2015)
ANKIT AIR-492 (2015)
UTSAV KAUSHAL AIR-500 (2015)
AKSHAY GODARA AIR-605 (2015)
MEET KUMAR AIR-646 (2015)
KUNAL DUDAWAT AIR-699 (2015)
NITHAN RAJ TN AIR-843 (2015)
SURYA KANT P AIR-886 (2015)
PRATAP SINGH B AIR-1060 (2015)
NITISH K. AIR-08 (2014)
GOWTHAM POTRU AIR-30 (2014)
BHAVESH MISHRA AIR-58 (2014)
K.Y. VIJAY AIR-143 (2014)
ANKIT VERMA AIR-145 (2014)
NIKHIL GOYAL AIR-159 (2014)
VIJAY GODWA G.C. AIR-175 (2014)
VALLURU KRANTHI AIR-230 (2014)
SWAPNIL KHARE AIR-236 (2014)
VARUN GUNTUPALLI AIR-261 (2014)
PARTH JAISWAL AIR-299 (2014)
MANISH GURWANI AIR-322 (2014)
ANURAG RAI AIR-371 (2014)
PARAS MANI T. AIR-433 (2014)
AJIT PRATAP SINGH AIR-436 (2014)
NIKHIL KR. GARG AIR-608 (2014)
RAJAT AGARWAL AIR-622 (2014)
SAURABH KATIYAR AIR-763 (2014)
PRATAP S. BHUKYA AIR-830 (2014)
BIPIN KUMAR AIR-861 (2014)
MEET KUMAR AIR-1150 (2014)
AJIT JOHN JOSHUA AIR-78 (2013)
SUMIT KUMAR AIR-81 (2013)
B. SASHI KANT AIR-111 (2013)
GOWTHAM POTRU AIR-318 (2013)
RAVINDER SINGH AIR-333 (2013)
ASHISH MODI AIR-350 (2013)
PARAS M TRIPATHI AIR-391 (2013)
NIKHIL GOYAL AIR-399 (2013)
NITISH K. AIR-547 (2013)
KULRAJ SINGH AIR-552 (2013)
VALLURU KRANTHI AIR-562 (2013)
SANTOSH KUMAR AIR-1013 (2013)
RAMESH RANJAN AIR-76 (2012)
ANKIT VERMA AIR-247 (2012)
B. SASHI KASNT AIR-329 (2012)
KRISHAN KANT AIR-550 (2012)
VISHAL GARG AIR-560 (2012)
PRADEEP MISHRA AIR-633 (2012)
KETAN BANSAL AIR-655 (2012)
SANJAY KR. JAIN AIR-667 (2012)
SANTOSH KUMAR AIR-849 (2012)
MEET KUMAR AIR-944 (2012)
HIMANSHU GUPTA AIR-07 (2011
Consolidated Reserve List-2011
ARIJIT MUKHERJEE AIR-25 (2011)
AJAY SINGH TOMAR AIR-88 (2011)
AWAKASH KUMAR AIR-168 (2011)
GULNEET SINGH AIR-220 (2011)
AJIT P SINGH AIR-288 (2011)
JAY YADAV AIR-372 (2011)
RAVI VERMA AIR-485 (2011)
MEGHA AGARWAL AIR-538 (2011)
G.J. KRUPAKAR AIR-796 (2011)
ABHISHEK MODI AIR-223 (2011)
BHAGWATI P KALAL AIR-154 (2010)
AWAKASH KUMAR AIR-276 (2010)
NAVNEET AGARWAL AIR-362 (2010)
AJIT P SINGH AIR-497 (2010)
SHAMBHU KUMAR AIR-47 (2009)
A. ARJUN AIR-140 (2009)
NISHA GUPTA AIR-507 (2009)
K.V.S.R. KISHORE AIR-575 (2008)
ONLY IMS PROVIDES SCIENTIFIC & INNOVATIVE TEACHING
METHODOLOGIES FULLY REVISED STUDY MATERIALS AND FULLY REVISED TEST SERIES.
HEAD OFFICE: 25/8, Old Rajender Nagar, Delhi-60. BRANCH OFFICE: 105-106, Top Floor, Mukherjee Tower Mukherjee Nagar, Delhi-9
Ph.:011-45629987, 9999197625 www.ims4maths.com e-Mail: ims4maths@gmail.com
Regional Office: H.No. 1-10-237, 2nd Floor, Room No. 202 R.K'S-Kancham's Blue Sapphire Ashok Nagar, Hyderabad-20. Ph.: 9652351152, 9652661152