Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

ATKT Examination
Jan 2017

Maximum Marks: **100** Duration: **3 hour**
Class: **S.Y.B.Tech** Semester: **IV** Program: **Mechanical Engineering**
Name of the Course: **Applied Mathematics IV** Course Code : **BTM401**

Master file.

Instructions:

- Attempt any FOUR questions out of remaining SIX questions.
- Question number.1 is compulsory.
- Answers to all sub questions should be **grouped** together.

Q		Marks	CO	Module
1(a)	The regression lines of a sample are $x+6y=6,\quad 3x+2y=10$. Find $\bar{x},\bar{y}$ and r.	5	1	1
(b)	In a random sample of size 500, the mean is found to be 20. In another independent sample of size 400, the mean is 15. Could the sample have been drawn from the same population with S.D = 4?	5	1	4
(c)	Solve the equation $3\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$. where $u(x, 0) = 4e^{-x}$ by the method of separation of variables.	5	3	6
(d)	Obtain the Fourier Series for $f(x)=x$ in $(-\pi,\pi)$	5	1	5
2 (a)	If the mean of the following probability distribution is 16, find m, n & variance	6	1	2
(b)	Obtain the Fourier Series for $f(x)=\lvert\cos x\rvert \qquad -\pi\le x\le\pi$.	6	2	5
(c)	A manufacturer produces medicine bottles of which 2% are defective. The bottles are packed in boxes containing 300 bottles. A drug manufacturer buys 1000 boxes. Using Poisson distribution find how many will contain (i) two defective bottles (ii) at least two defective bottles.	8	1	3

X	8	12	16	20	24
P(X)	1/8	m	n	1/4	1/12

3 (a)	Compute spearman's rank coorelation coefficient for the following data X: 18, 20, 34, 52, 12 Y: 39, 23, 35, 18, 46	6	1	1
(b)	Find the Fourier series corresponding to the function f (x) defined in $(-2,2)$ as follows $f(x)=2$ in $-2\le x\le 0$ $=x$ in $0<x<2$	6	2	5
(c)	A crv X has PDF defined as $f(x)=\begin{cases} kx, 0\le x\le 2 \\ 2k, 2\le x\le 4 \\ 6k-kx, 4\le x\le 6 \end{cases}$ .Find k, mean & $P(1\le X\le 3)$.	8	1	2
4 (a)	Obtain Half Range Fourier Cosine Series for the function $f(x)=\begin{cases} kx, & 0<x<\frac{l}{2} \\ k(l-x), & \frac{l}{2}<x<l \end{cases}$	6	2	5
(b)	Two independent samples from normal population with equal variance gave the following results Sample 1: Size 16, Mean 23.4, S.D 2.5 Sample 2: Size 12, Mean 24. 9, S.D 2.8 Is the difference between the mean significant?	6	1	4
(c)	If the mean of a binomial distribution is 3 and the variance is $3/2$, find the probability of obtaining atleast 4 success.	8	3	7
5 (a)	During war 1 ship out of 9 was sunk on an average in making a certain voyage. What was the probability that exactly 3 out of a convoy of 6 ships would arrive safely?	6	1	3

(b)	Following Table shows the respective heights x and y (in inches) of a sample of 10 father and their sons. Calculate rank correlation coefficients X: 65, 63, 67, 64, 68, 62, 70, 66, 68, 71 Y: 68, 66, 68, 65, 69, 66, 68, 65, 71, 70	**6**	**1**	**1**
(c)	Find a Fourier series to represent, $f(x)=\pi-x$ for $0<x<2\pi$.	**8**	**2**	**5**
6(a)	A machine is set to produce metal pieces of thickness 1.5cms with standard deviation 0.2cm.A sample of 100 plates produced by the machine gave an average thickness of 1.52cms.Is the machine fulfilling the purpose?	**6**	**1**	**4**
(b)	Obtain the complex form of the Fourier series of the function $f(x)=\begin{cases}0 & -\pi\le x\le 0\\ 1 & 0\le x\le\pi\end{cases}$	**6**	**2**	**5**
(c)	A string is stretched and fastened to two point's *l* apart. Motion is started by displacing the string in the form $y=a\sin\frac{nx}{\ell}$ from which it is released at time t = 0, show that the displacement of any point at a distance x from one end at time t is given by y (x, t) = $y=a\sin\frac{\pi x}{\ell}\cos\frac{\pi ct}{\ell}$.	**8**	**3**	**7**
7(a)	Obtain all possible solutions of one dimensional heat equation	**6**	**3**	**7**
(b)	A radioactive source emits particles at a rate of 10 per minute in accordance with Poisson law. Each particle emitted has a probability of $\frac{2}{5}$ being recorded. Find the probability that atleast 4 particles are recorded in a 2 minute period.	**6**	**1**	**2**
(c)	From the following data, find the equation of line of regression of y on x and estimate the most probable value of y when x = 9 X: 3, 6, 5, 4, 4, 6, 7, 5 Y: 3, 2, 3, 5, 3, 6, 6, 4	**8**	**1**	**1**

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Re-Examination, December 2016

S.Y.B.Tech., Sem-IV **B.Tech. in Mechanical Engineering**

Course: **FLUID MECHANICS (BTM 403)** Master file.

Max. Marks: 100 **Duration: 3 Hours**

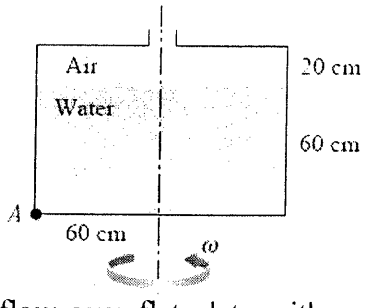
Instructions:

- Answer any **FIVE** from seven questions.
- Answers to all sub questions should be grouped together
- Make suitable assumption if needed with proper reasoning
- Figures on right in square bracket shows maximum marks for a particular sub-question.
- Figure on the extreme right shows **course outcome number** and **module number** respectively as per the syllabus of the course.

1. A. Explain following with illustration: **[10]** 1,2 /2, 3,4

   a. Lagrangian and Eulerian motion of fluid particle
   b. Viscous and Inviscid flows
   c. Incompressible and compressible flow
   d. Uniform and non-uniform flows

   B. The cylinder as shown in adjacent figure, is rotated about the central axis. What rotational speed is required so that the water just touches top corner. Also, find the pressure at point A and force acting at the bottom of the tank. **[10]**



2. A. Derive Von Karmon Momentum Integral equation for flow over flat plate with zero pressure gradients. List salient features of this approach. **[10]** 3,6

   B. Determine the viscous drag, torque and power absorbed on one surface of a collar bearing of 0.2 m ID and 0.3 m OD with an oil film thickness of 1 mm and a viscosity of 0.03 Ns/m^2 if it rotates at 500 rpm. If speed is changed to 800 rpm, find change in viscous drag, torque and power absorbed **[10]** 1,1

3. A. Stating the assumption made, derive a generalized hydrostatic equation where fluid body is at an uniform accelerated condition. Provide few examples where such condition exists. **[10]** 1,2

   B. Two reservoirs 5.2 km apart are connected with a pipeline which consists of a 225 mm diameter pipe for the first 1.6 km sloping at 5.7 m per km. For remaining distance the pipe diameter is 150 mm laid at a slop of 1.9 m per km. The levels of water above the pipe opening are 6 m in the upper reservoir and 3.7 m in lower reservoir. Taking f=0.024 for both pipes and coefficient of contraction =0.6, calculate the rate of **[10]** 2,4

discharge through the pipeline.

4. A. State the characteristic features of turbulence? How to represent a turbulent velocity profile? Discuss. **[10]** 3,5

   B. Define metacentre and metacentric height. **[10]** 1,2
   State the conditions for the stability of floating bodies. Support your answer with sufficient illustration.

5. A. Consider two long, horizontal parallel plates with a viscous incompressible fluid placed between them. The two plates moves in two opposite direction with two different constant velocities. There is no pressure gradient and the only body force due to the weight. Starting with the Navier-Stokes equation, determine an expression for the velocity profile for laminar flow between the two plates. **[10]** 1,4

   B. $$\frac{dA}{A} = \frac{dP}{\rho V^2}\left[1-M^2\right] = -\frac{dV}{V}\left[1-M^2\right]$$ **[10]** 2,7
   Derive above relation for compressible flow through a variable area. List down the assumptions made. All variables carries their usual meaning.

6. A. Starting from N-S equation applied to a stream line, derive Bernoulli's equation of flow streamline. Discuss its significance and conditions for validity. **[10]** 2,4

   B. Explain the concept of flow separation and discuss about various methods to control it. **[10]**

7. A. What is Mach Number? State its significance in compressible flow analysis? Classify flow based on it. Develop an expression for stagnation temperature as a function of Mach Number. **[10]** 1,7

   B. For a certain incompressible 2D flow field the velocity field in the y direction is given by the equation $v = x^2 + 2xy$. Determine velocity component in the x-direction. **[10]** 1,3