

S.Y.B.Tech.(Mech) sem IV  
 Fluid Mechanics A. 6.1.16  
 BHARATIYA VIDYA BHAVAN'S



## SARDAR PATEL COLLEGE OF ENGINEERING



Munshi Nagar, Andheri (West), Mumbai 400 058  
 (A Government Aided Autonomous Institute)

Re- Examination, January 2016

S.Y.B.Tech (Mechanical), SEM-IV

FLUID MECHANICS

Duration: 3 Hour

Max Marks: 100

Instructions:

- Answer any FIVE (05) questions.
- Figure to the right of questions indicate full marks.
- Make suitable assumption if required.
- Answers to all sub-questions should be grouped together.

Master File

- 1 a) Distinguish between following fluid motion- 10
  - i. Laminar and Turbulent flow
  - ii. Rotational and Irrotational flow
  - iii. Newtonian and non-Newtonian flow
  - iv. Viscous and Inviscid flow
  - v. Compressible and Incompressible flow
- b) Assume a steady incompressible laminar parallel flow between two parallel plates separated by a small gap 'b' and moving in opposite direction with equal velocity. Develop a governing equation for the problem using 2D-Navier Stokes equation and derive an expression for velocity profile. Estimate following quantities: 10
  - (i) Maximum and average velocity, (ii) Volume flow rate, and (iii) Pressure drop
2. a) Derive Bernoulli's equation and specify all assumptions made in the derivation. 10
- b) Water flows at the rate of 200 liter/s upwards through a tapered vertical pipe. The diameter at the bottom is 240 mm and at the top 200 mm and the length is 5m. The pressure at the bottom is 8 bar, and the pressure at the top is 7.3 bar. Determine the head loss through the pipe. Express it as a function of exit velocity head. 10
- 3 a) Mention any two flow measuring devices. Draw their sketch and explain their working. Using Bernoulli equation, derive an expression to estimate the volume flow rate through a one of the device. 10
- b) A window in the shape of an isosceles triangle and hinged at the top is placed in the vertical wall of a form that contains liquid concrete. Determine the minimum force that must be applied at point D to keep the window closed for the configuration of form and concrete shown. (Refer Fig. 1) 10
- 4 a) A tank 0.4 m × 0.2 m size and of height 0.4 m is filled with water upto a depth of 0.2 m. The mass of the container is 10 kg. The container slides without friction downwards on a surface making 30° with the horizontal. Determine the angle the free surface makes with the horizontal. If the tank is moved up with the same acceleration 10

determine the slope of the free surface.

- b) A 30 cm pipe with friction factor  $f = 0.024$  carries water to a turbine at the rate of  $0.25 \text{ m}^3/\text{s}$  over a distance of 160 m. The difference in levels between the water inlet and turbine inlet is 36 m. Determine the efficiency of transmission. The turbine outlet delivery is submerged into the tailrace and the velocity at the exit is 0.4 times the velocity in the pipe. 10
- 5 a) What is boundary layer? Explain Prandtl's theory and deriving the equation of motion and write down the boundary layer equation. 10
- b) Assuming second degree velocity distribution in the boundary layer, determine using the integral momentum equation, the thickness of boundary layer friction coefficient, displacement and momentum thicknesses. 10
- 6 a) A large thin plate is pulled through a narrow gap filled with a fluid of viscosity  $\mu$  on the upper side and a fluid of viscosity  $c\mu$  on the lower side. Derive an expression for the location of the plate in the gap for the total force to be minimum. 10
- b) A velocity profile proposed to be  $u = \frac{10y}{x^2 + y^2}$ ,  $v = \frac{10x}{x^2 + y^2}$ ,  $w = 0$  10
- i. Is this a possible incompressible flow?
- ii. If so, find the pressure gradient assuming frictionless air flow with z-axis vertical. Use  $\rho = 1.23 \text{ kg/m}^3$ .
- 7 a) Define and explain following terms: 10
- a) Density and Specific gravity
- b) Viscosity
- c) Surface tension
- d) Compressibility of fluid
- b) Explain the importance of the study of fluid forces on surfaces and submerged bodies. Derive an expression for the force on a thin plate of given arbitrary shape immersed in a liquid at an angle  $\theta$  to the free surface. 10

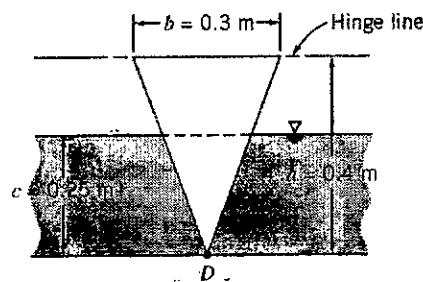


Fig. 1

S.Y.B.Tech. (Mech) Sem IV  
Theory of Machines - I

BHARATIYA VIDYA BHAVAN'S

**SARDAR PATEL COLLEGE OF ENGINEERING**Munshi Nagar, Andheri (West), Mumbai 400 058  
(A Government Aided Autonomous Institute)kt-exam Jan-2016Course: BTM402 – Theory of Machines-I

Duration: 4 hours

Marks: 100

Class/Branch: Second year B. Tech. (Mechanical)Semester: IV

Note:

- Question No 1 is compulsory
- Attempt any four questions out of remaining six.
- Assume suitable data if required and state it clearly.
- Figures to right indicate full marks.
- Answers to all sub-questions should be grouped together. Master file.

- Q1. Answer the following
- a) What parameters of two pair of gears should be same for proper meshing? 05  
Define them.
- b) Draw the neat sketch of Pantograph and describe its working principal. 05
- c) What do you meant by open belt and cross belt arrangement? Discuss the advantages and dis-advantages of both. 05
- d) Discuss the mobility of mechanism using Grubler's equation; also prove that four bar linkage is the simplest mechanism. 05
- Q2. a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gear is involute with  $20^\circ$  pressure angle, 12mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio. 10
- b) Two involute gears of  $20^\circ$  pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If module is 5mm and pitch line speed is 1.2 m/s, assuming addendum is equal to one module, find: 10
1. The angle turned through by pinion when one pair of teeth is in contact.
  2. Maximum velocity of sliding.
- Q3 a) When two equal gears mesh without interference, show that the minimum number of teeth  $N$  of these gears must satisfy the relation:  $3N^2 \sin^2 \alpha - 4fN - 4f^2 = 0$ , where  $f$  is fraction of module to expresses the addendum/dedendum, and  $\alpha$  is pressure angle. 08
- b) What is law of gearing? Derive the expression for it with neat sketch. 08
- c) Compare the belt drive over the gear drive. 04

①

- Q4 a) A shaft which rotates at a constant speed of 160 rpm is connected by belting to a parallel shaft 720mm apart, which has to run at 60, 80 and 100 rpm. The smallest pulley on driving shaft is 40mm in radius. Determine the remaining radii of the two stepped pulleys for a crossed belt and an open belt. Neglect belt thickness and slip. 12
- b) For a flat belt drive, prove that—  $T_1/T_2 = e^{\mu\alpha}$ , where 08  
 $T_1$  = tension in the tight side,  $T_2$  = tension in the slack side,  $\mu$  = coefficient of friction between the belt and pulley,  $\alpha$  = angle of contact between belt and pulley. (draw the neat sketch of the drive and show the terms used above).
- Q5 Deduce the expression for displacement velocity and acceleration for a slider, in slider crank mechanism using analytical method (complex algebra); also explain the graphical method to find velocity and acceleration for slider crank mechanism. 20
- Q6 a) Derive the expression for displacement, velocity and acceleration for following cam motion: i) SHM, ii) UARM, iii) Cycloidal motion. (use  $h$  = follower stroke,  $\theta_a$  = angle of ascent,  $\theta_d$  = angle of descent,  $\omega$  = angular speed of cam,  $x$  = displacement of follower at any time  $t$ ). 15
- b) A chain drive is used for reduction of speed from 240 rpm to 120 rpm. The number of teeth on driving sprocket is 20. Find the number of teeth on driven sprocket. If the pitch circle diameter of the driven sprocket is 600mm and center to center distance between the two sprockets is 800mm, determine the pitch and length of the chain. 05
- Q7 a) What is the condition of correct steering? Derive. Also draw neat sketches of Davis and Ackerman steering mechanism. 05
- b) Discuss Peaucellier straight line generating Mechanism. 05
- c) Explain the phenomenon of interference in gears. What are the methods to avoid the interference? 05
- d) What do you mean by inversion of a kinematic chain? Draw sketch and name at least one inversion of a four bar kinematic chain with two revolute and two prismatic pairs. 05

S.Y.B.Tech. (Mech) sem IV  
Manufacturing Science-II  
Bharatiya Vidya Bhavan's



### Sardar Patel College of Engineering

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



KT Exam  
January 2016

Max. Marks: 100  
Class: S.Y.B.Tech.  
Name of the Course: Manufacturing Science II

Semester: IV

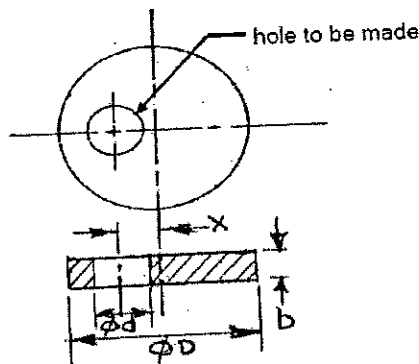
Duration: 3 hours  
Program: B.Tech. Mechanical Engineering  
Course Code : ME255

#### Instructions:

1. Attempt any five questions out of seven.
2. Draw neat diagrams
3. Assume suitable data if necessary
4. Figures to the right indicate full marks

Master file.

- Q1 a) State the design requirements for tool force dynamometers 05  
b) Explain briefly the essential elements of a jig/fixture 05  
c) Discuss the effects of nose radius on tool life with neat sketches 05  
d) Explain the following types of rolling mills with neat sketches 05  
i. Two high rolling mill  
ii. Three high rolling mill  
iii. Four high rolling mill  
iv. Multi-roll rolling mill  
v. Universal rolling mill
- Q2 a) Design a jig to drill a through hole in pre-machined mild steel circular disc at a given distance 'x' from the centre of the disc as indicated. Explain the construction and working of the jig 10



- b) Explain the construction and working of a drilling tool force dynamometer with neat sketches 10
- Q3 a) Explain with neat sketches the basic metal cutting process 05  
b) Explain briefly the different defects observed in forged components (any 10 defects) 10

- c) Develop the dimension 38.7125 mm, by using slip gauges from M112 set, for the following two conditions: 05
- Without protection blocks
  - With protection blocks of 2.5mm each.

Range (mm)	Step (mm)	Pieces
1.001 to 1.009	0.001	9
1.01 to 1.49	0.01	49
0.5 to 24.5	0.5	49
25 to 100	25	4
1.0005	-	1
Total		112

- Q4** a) Explain the term material length standards. State any 3 disadvantages of material length standards as compared to wave length standards. 05
- b) With neat sketches explain the following terms associated with a drilling tool 10  
(i) Point angle, (ii) Lip relief angle, (iii) Helix angle, (iv) Web, (v) Body diameter clearance.
- c) Explain open die forging with neat sketches 05
- Q5** a) With a neat labeled sketch, explain the working mechanism of a dial indicator. Also state any four applications of dial gauge 10
- b) Explain the term 'spring-back'. With neat sketches, briefly describe the different techniques used to control spring back. 10
- Q6** a) With a neat sketch, explain the construction and working of a combination die. 10
- b) State the design principles for drill bushings 05
- c) Explain the different stages that comprises a measurement process 05
- Q7** a) Explain the construction and working of Reed type mechanical comparator with neat sketches 05
- b) Sketch Merchant's force circle and explain its various components. Also state the significance of Merchant's circle. 10
- In an orthogonal cutting operation, the following data has been observed:
- chip thickness ratio  $r = 0.383\text{mm}$   
 rake angle  $\alpha = 15^\circ$   
 Width of cut  $b = 3\text{mm}$   
 uncut chip thickness  $t = 0.5\text{mm}$   
 width of cut  $b = 3\text{mm}$   
 shear strength  $= 280\text{N/mm}^2$   
 coefficient of friction  $= 0.7$
- Determine the shear force.
- c) Explain box type jig with neat sketches 05

# SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Jan 2016

Total Marks: 100

Duration: 3 Hours

CLASS/SEM: S.E (MECHANICAL)/IV (KT-EXAMINATION)

SUBJECT: APPLIED MATHEMATICS IV

Master file.

- Question no. I is compulsory.
- Attempt any **FOUR** questions out of remaining **SIX** questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.

- Q1.a) Obtain the Fourier Series for  $f(x) = x$  in  $(0, 2\pi)$  06
- Q1.b) A drug is given to 10 patients and increments in their blood pressure were recorded to be 3, 6, -2, 4, -3, 4, 0, 0, 2, 6. 06  
Is it reasonable to believe that the drug has no effect on change of blood pressure?
- Q1.c) Obtain complex form of the Fourier series for  $f(x) = e^{-x}$   $-\pi \leq x \leq \pi$  08
- Q2.a) If the mean of a binomial distribution is 3 and the variance is  $\frac{3}{2}$ , find the probability of obtaining atleast 4 success. 06
- Q2.b) Solve the equation  $3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$ . where  $u(x, 0) = 4e^{-x}$  06  
by the method of separation of variables.
- Q2.c) Show that the functions  $\varphi_1(x) = 1$   $\varphi_2(x) = x$  &  $\varphi_3 = \frac{1}{2}(3x^2 - 1)$  are orthogonal over  $(-1, 1)$  08
- Q3.a) In usual notations solve the one dimensional HEAT EQUATION. 06
- Q3.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. 06
- Q3.c) By using the sine series for  $f(x) = 1$  in  $0 < x < \pi$ . Hence using parseval identity show that 08  
 $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \dots$
- Q4.a) A drawer contains 50 bolts and 150 nuts. Half of the bolts and half of the nuts are rusted. If one item is chosen at random, what is the probability that it is rusted or is a bolt? 06

Q4.b) Obtain the Fourier Series for

$$f(x) = |\cos x| \quad -\pi \leq x \leq \pi$$

06

Q4.c) A crv X has PDF defined as  $f(x) = \begin{cases} A+Bx, 0 \leq x \leq 1 \\ 0, elsewhere \end{cases}$

08

If the mean of the distribution is 1/3. Find A & B.

Q5.a) Compute spearman's rank coorelation coefficient for the following data

06

X	10	12	18	18	15	40
Y	12	18	25	25	50	25

Q5.b) Derive the one dimensional heat equation.

06

Q5.c) The mean weight of 500 male students at a certain college is 151 lb and standard deviation is 15 lb.

08

Assuming that the weights are normally distributed, find how many students weigh

- i) Between 120 & 155 lb      ii) More than 185 lb

Q6.a) The heights of six randomly chosen sailors are in inches: 63, 65, 68, 69, 71 & 72. The heights of ten randomly chosen soldiers are: 61, 62, 65, 66, 69, 69, 70, 71, 72 & 73. Discuss in the light of this data that the soldiers on an average are taller than sailors

06

Q6.b) A tightly stretched string with fixed end points  $x = 0$  and  $x = l$  is initially in a position given by  $y = y_0 \sin^3(\pi x/l)$ . If it is released from rest from this position, find the displacement  $y(x, t)$ .

06

Q6.c) Find the correlation coefficient for the following

08

X (Height of father)	165	160	170	163	173	158	178	168	173	170	175	180
Y (Height of Sons)	173	168	173	165	175	168	173	168	180	170	173	178

Q7.a) Fit a binomial distribution for the following data and compare the theoretical frequencies with the actual ones:

06

X	0	1	2	3	4	5
f(x)	2	14	20	34	22	8

Q7.b) The following data gives the heights in inches(X) and weights in lbs(Y) of a random sample of 10 students

06

X	61	68	68	64	65	70	63	62	64	67
Y	112	123	130	115	110	125	100	113	116	126

Estimate the weight of a student with height 59 inches

Q7.c) In an experiment on pea - breeding mendel obtained the following frequencies of seeds.  
 315 Round and Yellow

08

(2)



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Applied Mathematics-IV Dt. 04/01/16.

101 Wrinkled and Yellow

108 Round and Green

32 Wrinkled and Green

According to his theory of heredity the numbers should be in population 9:3:3:1. Is there any evidence to doubt the theory at 5% Los?

(3)

