MECH/PROD/IV/AM-IV

15/05/15
MECH & PROD

QP Code : 3451

Rev Course

(3 hours) [Total Marks: ~~100~~ 80

1.Q1 is compulsory
2. Solve any three out of the remaining from Q.2 to Q. 6.
3. Figures on the right hand side indicate marks.
4. Use of statistical tables is allowed.

Q.1. a) A continuous random variable with P.D.F. f(x) = k x(1-x), $0 \leq x \leq 1$. Find K and determine a number b such that $P(x \leq b) = p(x \geq b)$. 5

b) If $A=\begin{bmatrix}2 & 2 & 1\\ 1 & 3 & 1\\ 1 & 2 & 2\end{bmatrix}$, Find the characteristic roots of A and $A^3 + I$. 5

c) By using Green's theorem Show that the area bounded by a simple closed curve c is given by $\frac{1}{2}\int_c xdy - ydx$ 5

d) If the tangent of the angle made by the line of regression of y on x is 0.6 and $\sigma_y = 2\sigma_x$. Find the correlation coefficient between x and y. 5

Q. 2. a) The means of two random samples of size 9 and 7 are 196.42 and 198.82 respectively. The sum of the squares of the deviation from the means is 26.94 and 18.73 respectively. Can the sample be considered to have been drawn from the same population? 6

b) If the vector field $\bar{F}$ is irrotational, find the constants a,b,c where $\bar{F} = (x + 2y + az)\bar{\imath} + (bx - 3y - z)\bar{\jmath} + (4x + cy + 2z)\bar{k}$ Show that $\bar{F}$ can be expressed as the gradient of a scalar function. Then find the work done in moving a particle in this field from (1,2,-4) to (3,3,2) along the straight line joining the points. 6

c) Using the Kuhn Tucker conditions solve the following N.L.P.P. Maximize $Z=x_1^2 + x_2^2$, subjected to $x_1 + x_2 - 4 \leq 0$ *and* $2x_1 + x_2 - 5 \leq 0$, $x_1, x_2 \geq 0$. 8

[Turn over

Q3. a)Seven dice are thrown 729 times. How many times do you expect at least four dice to show three or five? 6

b) Evaluate by using Stokes theorem, $\int_c xydx + xy^2dy$, c is the square in xy- plane with vertices (1,0),(0,1), (-1,0)and (0,-1). 6

c) In a laboratory experiment two samples gave the following results. Test the equality of sample variances at 5% level of significance. 8

Sample	size	mean	Sum of squares of the deviations from mean
1	10	15	90
2	13	14	108

Q. 4. a)Can it be concluded that the average life span of an Indian is more than 70 years, if a random sample of 100 Indians has an average life span of 71.8 years with the Standard deviation of 7.8 years . 6

b) Use Gauss's divergence theorem to evaluate where $\iint_S \overline{N}.\overline{F}dS$, $\overline{F}=(4x\bar{\imath} - 2y^2\bar{\jmath} + z^2\bar{k}$, and S is the region bounded by $x^2 + y^2 = 4, z = 0, z = 3$. 6

c) Using Lagrange's method of multipliers solve the NLPP, Optimize $Z= 4x_1 + 8x_2 - x_1^2 - x_2^2$ subjected to $x_1 + x_2 = 4, x_1, x_2 \geq 0$ 8

Q.5. a) Show that the matrix $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix. 6

b) Calculate the Karl Pearson's coefficient of correlation for the following data. 6

x	28	45	40	38	35	33	40	32	36	33
y	23	34	33	34	30	26	28	31	36	35

[Turn over

c) The following table gives the number of accidents in a city during a week. Find whether the accidents are uniformly distributed over a week, using χ^2test. 8

day	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Total
No of accidents	13	15	9	11	12	10	14	84

Q6.

a) Find A^{50} if $A=\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}$ 6

b) The monthly salary in a big organization is normally distributed with mean Rs. 3000, and standard deviation of Rs. 250. What should be the minimum salary of a worker in the organization so that the probability that he belongs to top 5% workers. 6

c) Verify green's Theorem in the plane for where $\int_C (xy+y^2)dx+x^2dy$

c is the closed curve of the region bounded by $y=x$ and $y=x^2$. 8

Sem-IV / Fluid Mechanics / 21-05-15 / MECH

QP Code : 3470

(03 Hrs) [Total Marks 80]

N.B.:
(1) **Question No.1 is compulsory**
(2) Attempt any **three** questions out of remaining **five** questions
(3) Figures to right indicate full marks
(4) Assume suitable data if **necessary and justify the same.**

Q.1(A) Explain Newton's law of viscosity and concept of continuum of fluid 05

(B) A two dimensional flow is described in the Langrangian system as 05

$$x = x_0 e^{-kt} + y_0(1 - e^{-2kt})$$

and

$$y = y_0 e^{kt}$$

Find :
(i) the equation of a fluid particle in the flow field and
(ii) the velocity components in Eulerian system

(C) Write short note on boundary layer separation and methods to control it. 05

D) An aeroplane is to move at Mach number of 1.5 at altitude of 1000 m. The atmospheric pressure and densities at this elevation are 89.89 KPa (abs) and 1.112 Kg/m^3 respectively. Calculate the speed of the plane in Km/h at this altitude. Assume ratio of specific heats k=1.4. 05

[TURN OVER

Q. 2(A) A hemisphere projection of diameter 0.6 m exists on one of the vertical sides of a tank. If the tank contains water to an elevation of 1.5 m above the centre of the hemisphere, calculate the vertical and horizontal forces acting on the projection. 10

(B) The diameter of a pipe bend is 30 cm at inlet and 15 cm at outlet and the flow is turned through 120^0 (angle measured in clockwise direction between direction of fluid flow at inlet and outlet) in a vertical plane. The axis at inlet is horizontal and the centre of the outlet section is 1.5 m below the centre of the inlet section. Total volume of water in the bend is 0.9 m^3. Neglecting friction, calculate the magnitude and direction of the force exerted on the bend by water flowing through it at 250 litres/s and when inlet pressure is 0.15 N/mm^2. 10

Q.3 (A) A venturimeter is installed in a pipeline carrying water and is 30 cm in diameter. The throat diameter is 12.5 cm. The pressure in pipeline is 140 KN/m^2, and the vacuum in the throat is 37.5 cm of mercury. Four percentages of the differential head is lost between the gauges. Working from first principles find the flow rate in the pipeline assuming the venturimeter to be horizontal. 10

(B) If velocity distribution, u in laminar boundary layer over a flat plate is assumed to be given by second order polynomial $u=a+by+cy^2$, where y is the perpendicular distance measured from the surface of the flat plate, and a, b and c are constants. Determine the expression of velocity distribution in dimensionless form as $\frac{u}{U}=f\left(\frac{y}{\delta}\right)$, 10

where, U is main stream velocity at boundary layer thickness δ. Further also find boundary layer thickness in terms of Reynolds number.

[TURN OVER

Q. 4(A) Fluid is in laminar motion between two parallel plates separated by distance 'b' under the action of motion of one of the plates and also under the presence of a pressure gradient in such a way that the net forward discharge across any section is zero. Consider 'U' be the velocity of the moving plate. 10

(i) Find out the point where minimum velocity occurs and its magnitude

(ii) Draw rough sketch of velocity distribution across any section.

(B) The velocity potential function for two dimensional flow is $\phi = x(2y-1)$ determine: (i) velocity, and (ii) stream function. 10

Q.5(A) Explain eddy viscosity theory for turbulent fluid flow. 05

(B) What is critical pressure ratio for compressible flow in nozzle? Explain its significance. 05

(C) The pressure, velocity and temperature just upstream of a normal shock wave in air are 100 KPa (abs), 660 m/s and -20^0C respectively. Calculate the pressure, velocity and temperature just downstream of the shock wave. [Take ratio of specific heats k=1.4 and gas constant R=287 J/(Kg.K)]. 10

Q.6 (A) A pipeline carrying water has a diameter of 0.5 m and is 2 Km long. To increase the delivery another pipeline of the same diameter is introduced parallel to the first pipe in the second half of its length. Find the increase in discharge if the total head loss in both the cases is 15 m. Assume 4f=0.02 for all the pipes. 10

(B) Draw rough nature of Moody chart showing different regimes of fluid flow and explain its significance 05

(C) Write short note on stalling of aerofoil. 05

S.E / Sem-IV / CBGS / Mech / Industrial Electronics.
12/06/15

QP Code : **3483**

(3 Hours) [Total Marks :80

N.B. : (1) Questions No. 1 is compulsory.
(2) Attempt **any three** out of remaining questions.
(3) Figure to right indicates full marks.
(3) Assume suitable data if necessary.

1. Solve any **five** 20
(a) Draw and explain labelled V-I Characteristics of Zener diode.
(b) Classify single phase controlled rectifier.
(c) State important features of op-amp
(d) Realize basic gates using NAND gate
(e) Explain back EMF in DC motor.
(f) Draw generalized architecture of microcontroller

2. (a) Draw and explain single phase full bridge controlled rectifier with the help of waveforms for R-load, Derive the output voltage equation. 7
(b) Explain architecture of MSP430 7
(c) Compare R & R C triggering methods of SCR. 6

3 (a) Explain IC555 as monaostable multivibrator. 7
(b) Compare CMOS and TTL logic family 7
(c) Draw and explain torque-speed characteristics of DC series and DC shunt motor, Also state application of each. 6

4 (a) Explain first order filter circuit. 7
(b) Explain various registers used for digital I/O of MSP430 7
(c) Analyse torque-speed characteristics of induction motor. State various methods of speed control of induction motor. 6

5 (a) What is commutation of SCR? Explain any one method in detail 7
(b) Explain closed loop speed control of DC motor, What is the necessity of inner current loop 7
(c) What is decoder, Demultipexer and flip-flop 6

6 (a) Explain suitability of different electric motors for various industrial applications. 7
(b) Explain with appropriate waveforms the operation of single phase bridge inverter circuit. 7
(c) Explain different peripherals of MSP430, Why is it called as mixed signal processor? 6

Sem-IV / Materials Technology / 08-6-15 / MECH

QP Code :3480

Question .1 is compulsory. *Time: 3hours*

Solve any three questions from the remaining. *Marks: 80*

Marks are indicated on the right.

Q.1	Answer **any four** from the following:	20
	a. Discuss the allotrophic modifications of pure Iron.	
	b. Define fracture and discuss various types of fracture.	
	c. What are dislocations? Classify them and discuss any one of them.	
	d. What is nitriding? How is it practised?	
	e. What are composites? Give a classification of composites.	
Q.2	a. What is deformation? Explain the slip mode of deformation	7
	b. Define Fatigue. Draw the S-N curve and explain its interpretation.	7
	c. Derive an expression for CRSS.	6
Q.3	a. Draw a neat and labeled Fe-Fe_3C diagram.	7
	b. Discuss the cooling of 0.4 % C steel.	6
	c. Explain the method of carburizing; also give examples of parts that are carburized.	7
Q.4	a. State Griffith's criteria of brittle fracture and derive the equation.	7
	b. Draw neat and labelled microstructures of grey cast iron, 0.8% C steel and low carbon steel.	7
	c. Define Hardenability and discuss factors affecting it.	6
Q.5	a. What are the various methods used for processing of polymers? Explain any one in detail.	7
	b. What are High speed steels? How are they heat treated?	7
	c. How are stainless steels classified? Discuss their properties and applications.	6
Q.6	Write short notes on **any four**:	20
	a. Recrystallisation annealing	
	b. Stages of Creep	
	c. Methods used for nanomaterials synthesis	
	d. TTT diagram and its importance	
	e. Types of Cast irons.	

JP-Con. 12397-15.

Production Process 2 - May 2015

TOTAL MARKS: 80
TOTAL TIME: 3 HOURS

(1) Question 1 is compulsory.
(2) Attempt any **three** from the remaining questions.
(3) Assume data if required.
(4) Figures to the right indicate full marks.

Attempt any five of following:

1 (a) Explain types of chips produced during machining process. (4 marks)

1 (b) What are the features of a Horizontal CNC machine? (4 marks)

1 (c) Write a note on Gear hobbing and its types. (4 marks)

1 (d) Explain different features of Surface finish. (4 marks)

1 (e) Write a note on oil based cutting fluids. (4 marks)

1 (f) Write a short note on carbide inserts. (4 marks)

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2 (a) Explain the design procedure for a broach tool with help of diagram. (10 marks)
:IMAGE-

2 (b) Write a note on different types of cutting tool materials with their applications. (10 marks)

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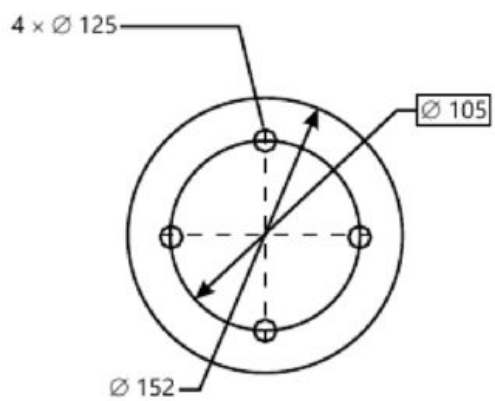
3 (a) Write a CNC program for drilling operation for making 4 X ? 12.5 holes in the plate as shown below, its thickness is given as 10 mm and explain at the steps in detail. (10 marks)



3 (b) Calculate and design a drill tool for machining a hole of diameter 15 mm and length 20 mm in a work piece of carbon steel, specific cutting force=3500 N/mm^2, Draw the drill bit and indicate designed values. (10 marks)

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4 (a)in an orthogonal cutting, the following observations were made. (10 marks)
Rake Angle: 10°, Cutting Speed: 50 m/min, Chip Thickness 0.4 mm, Uncut chip thickness 0.148 mm, Depth of Cut 2 mm, Cutting Force 1500 N, Thrust force: 1000N. Calculate (i) Chip reduction coefficient, (ii) Shear Angle, (iii) Shear Force, (iv) Force Normal to the shear plane, (v) Frictional Force (vi) Normal to frictional force (vii) Shear stress (viii) Shear strain (ix) coefficient of friction (x) Resultant Force.

4 (b) How is a gear manufactured? And also explain the limitations of the different processes. (10 marks)

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5 (a) Derive an expression for optimum cutting speed and tool life for both minimum production cost and maximum production rate during machining process. (10 marks)

5 (b) Derive the modified Merchants theory along with diagram and assumptions. (10 marks)

Write short notes on

6 (a) Honing Machine (5 marks)

6 (b) Types of Shaping machines (5 marks)

6 (c) Forces represented in Merchant's Circle Diagram. (5 marks)

6 (d) Tool geometry in the ASA system. (5 marks)

Sem - IV / Theory of Machines - I / MECH
27-05-15

QP Code : 3474

(3 Hours) **[Total Marks : 80**

N.B. 1) Question No.1 is compulsory.

(2) Attempt any three questions out of the remaining five questions.

(3) Figures to the right indicate full marks.

(4) Assume suitable data wherever required with justification.

Q1. Attempt any 4 **(20)**

a) Differentiate between Davis and Ackerman steering gears.

b) Define pressure angle with respect to cams. Explain the methods to control the pressure angle.

c) State and explain Law of gearing.

d) What is chordal action in chain? Explain

e) Explain Grubler's criteria for mobility of mechanism with example.

Q2.

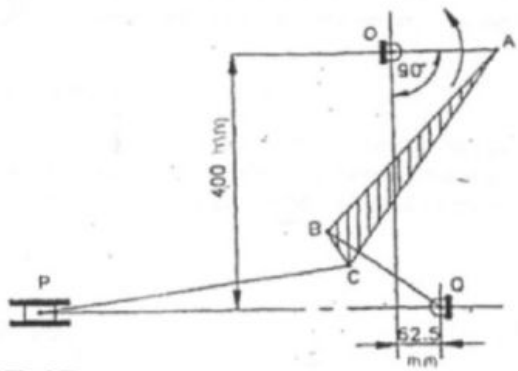
a) Differentiate between involute and cycloidal gear tooth profile. **(06)**

b) A cam rotating at 200 rpm operates a reciprocating roller follower of radius 2·5 cm. The least radius of the cam is 30mm and the stroke of the follower is 5 cm. Ascent takes place by UARM and descent by SHM. Ascent takes place during 70° and descent during 50° of cam rotation. Dwell between ascent and descent is 60°. Sketch displacement, velocity, acceleration and Jerk diagrams. **(14)**

Q3.

a) As shown in the following Fig.1, the crank OA makes 150 rpm. Find for the given configuration, the velocity of piston P by a) ICR method and b) Relative velocity method. OA=150mm, AB=375mm, AC = 400 mm, BC = 62.5 mm, BQ=200mm, CP = 450 mm. **(14)**

Fig.1



b) Explain Tchebicheff's straight line generating mechanism. (06)

Q4.

a) A right circular cylinder of radius r & mass m is suspended by a cord that is wound round its surface and the other end of the cord is held at support B, as shown in the fig.2. If the cylinder allowed to fall so that it unwinds itself under own weight, determine the acceleration of the centroid G of the cylinder and the tension T in the cord portion AB. (07)

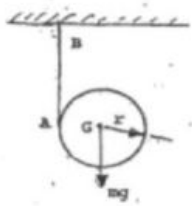


Fig.2

b) A chain drive is used for reduction of speed from 250 RPM to 120 RPM. The number of teeth on the driving sprocket is 20. Find the number of teeth on the driven sprocket. If the pitch circle diameter of the driven sprocket is 600mm and centre to centre distance between the two sprockets is 800 mm, determine the pitch and length of the chain. (07)

c) Derive the condition for the maximum power transmission by belt drive. (06)

Q5.

a) Derive the expression for minimum number of teeth on pinion to avoid interference with gear. (06)

b) Two gear wheels of diameters 75 mm and 250 mm have involute teeth of 5 mm module and 20° angle of obliquity. The addenda are equal and are as large as possible while avoiding interference. Find:

(i) The addendum (ii) The length of path of contact (07)

c) A Hooke's joint is used to couple two shafts together. The driving shaft rotates at a uniform speed of 1000 RPM. Find the greatest permissible angle between the shaft axes so that the total fluctuations of speed may not exceed 150 RPM. What will then be the maximum speed of the driven shaft?. (07)

Q6

Explain the following. (20)

a) Coriolli's acceleration component.

b) Peaucellier Straight line generating mechanism

c) Inversions of slider crank chain.

d) Methods to control interference in gears.