ME-IV-Rev
FM.

2013-14
(Reg.)

QP Code : NP-19710

(3 Hours) **[Total Marks : 100**

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.No.1 Answer any 4 **20**

(1) How fluids are classified? Represent different types of fluid on shear stress Vs velocity gradient plot.

(2) A fluid flow is given by $v_r = \left(1-\frac{a}{r^2}\right)\cos\theta$, $v_\theta = -\left(1+\frac{a}{r^2}\right)\sin\theta$

(i) Show that it represents a physically possible flow.

(ii) Determine whether the flow is rotational or irrotational.

(3) Define displacement thickness in boundary layer theory and derive its relation in terms of dimensionless velocity profile, $\frac{u}{U}$, where u is the velocity at a perpendicular distance y from the surface of the flat plate and U is the free stream velocity.

(4) An object is immersed in an air flow with a static pressure of 200 kPa (abs), a static temperature of 20^0 C, and a velocity of 200 m/s. What is the pressure and temperature at the stagnation point?

(5) Two discs of 250 mm diameter are placed 1.5 mm apart and the gap is filled with an oil. A power of 500 W is required to rotate the upper disc at 500 rpm while keeping the lower one stationary. Determine the viscosity of the oil.

Q.No.2

10

(1) Find the magnitude and direction of the resultant water pressure acting on a curved face of a dam which is shaped according to the relation $y = \frac{x^2}{9}$ as shown in Figure 1. The height of the water retained by the dam is 10 m. Consider the width of the dam as unity

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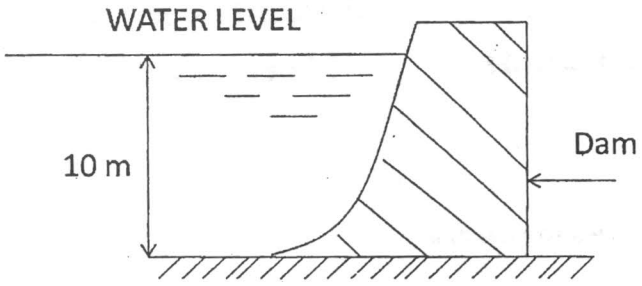

Fig.1

10

(2) For the velocity profile for laminar boundary flow $\frac{u}{U} = sin\left(\frac{\pi}{2}\frac{y}{\delta}\right)$.where u is the velocity at the distance y from the surface of the flat plate and U be the free stream velocity at the boundary layer thickness δ. Obtain an expression for the boundary layer thickness and the average drag coefficient in terms of the Reynold's number

Q.No.3 8

(1) Consider a viscous incompressible flow of a Newtonian fluid between two parallel planes, separated by a distance 'c'. One of the plates is stationary and the other is moving with a uniform velocity V. There is no pressure gradient in the flow. Workings from Navier-Stokes equation obtain the expression for the discharge and velocity distribution along the vertical direction (direction perpendicular to the direction of fluid flow).

6

(2) The streamline is represented by $\Psi = x^2 - y^2$. Determine (i) the velocity and its direction at (2,2), (ii) sketch the streamline and show the direction of flow

6

(3) A nozzle is designed to expand air isentropically to atmospheric pressure from a large tank in which properties are held constant at 5^0 C and 304 kPa (abs). The desired flow rate is 1 kg/s. Determine the exit area of the nozzle.

Q.No.4 8

(1) A pipeline 45 m long connects two reservoirs which have a difference of water level of 18 m. For a length of 20 m from the upper tank the pipe diameter is 40 mm and for the remaining part the pipe is 65 mm in diameter. At the change in section a partially

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open valve having a K value of 6 is fitted. Considering all major and minor losses calculate the flow rate through the pipeline. Take f =0.022 for both the pipes

6

(2) Explain what is meant by separation of boundary layer and describe in detail the methods to control the same?

6

(3) Derive an expression for discharge through an orifice meter. Draw a neat sketch of the orificemeter

Q.No.5 8

(1) A vertical reducing bend has a diameter of 300 mm at inlet and 150 mm at exit. The bend is initially horizontal and turns the flow through 120^0. The inlet pressure is 1.4 kg/cm^2 (g) and flow rate through the bend is 225 litres/sec. The exit is 1.4 m below the inlet. The total volume of oil in the bend is 85 litres. Assuming frictionless flow, use the equations of the control volume to determine the magnitude and direction of the resultant force on the bend. Draw a sketch of the set up.

4

(2) Write short note on induced drag in an aerofoil

8

(3) Drive the $1/7^{th}$ power law velocity profile for turbulent flow in a pipe

Q.No.6 8

(1) A converging –diverging nozzle with an exit area of 40 cm2 and a throat area of 10 cm2 is attached to a reservoir with T= 200C and p = 500 kPa absolute. Determine the the two exit pressures that result in M=1 at the throat for an isentropic flow. Also determine the associated exit temperatures and velocities.

6

(2) A pipe is connected to a pressurized chamber as shown in the diagram. If the jet of water issuing from the nozzle rises to a height of 14 m calculate the pressure in the tank. The pipe diameter is 60 mm and the nozzle exit diameter is 25 mm. Assume the flow to be frictionless

SE-Mechanical
Sem - IV - CBSGS.
TOM - I 29/5/14.

QP Code :**NP-19749**

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

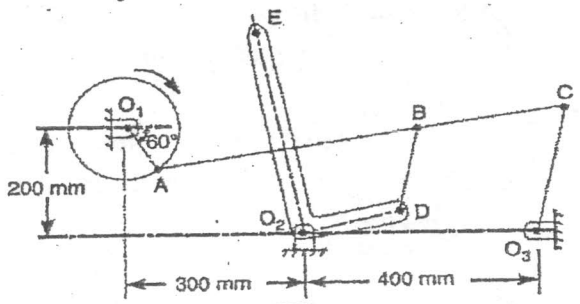
N.B. : (1) Question No. **1** is **compulsory.**
(2) Attempt any **three** questions out of the remaining **five** questions.
(3) Assume **suitable** data wherever **necessary.**

1. Attempt any **four** :— **20**
   (a) What do you mean by initial tension in belt drive ?
   (b) With the help of a simple four bar mechanism explain the types of instantaneous centres.
   (c) Explain the term pressure angle with respect to a cam mechanism. What are the methods to control it ?
   (d) Explain the types of constrained motions.
   (e) With the help of a neat sketch explain Grasshopper's mechanism.

2. (a) A cam with a minimum radius of 25 mm is to be designed for a knife edge follower with the following data :— **14**
   (i) to raise the follower through 35 mm during 60° rotation of the cam.
   (ii) dwell for the next 40° of the cam rotation.
   (iii) descending of the follower during the next 90° of the cam rotation.
   (iv) dwell during the rest of the cam rotation.
   if the ascending and descending of the cam is with SHM and UARM respectively. Draw the displacement, velocity, acceleration and jerk diagram if the cam rotates at 150 rpm.

   (b) The universal coupling is used to connect two shafts together. The input shaft rotates at a uniform speed of 1200 rpm. Find the greatest permissible angle between the shaft axes so that the total fluctuation of speed may not exceed 200 rpm. Also find the maximum speed of driven shaft. **6**

3. (a) The mechanism of a wrapping machine as shown in the **figure** has the following dimensions :— **14**
   O_1A =100 mm; AC = 700 mm; BC = 200 mm; O_3C = 200 mm; O_2E = 400 mm; O_2D = 200 mm and BD = 150 mm. The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of the point E of the bell crank lever by :
   (i) Instantaneous centre method.
   (ii) Relative velocity method.



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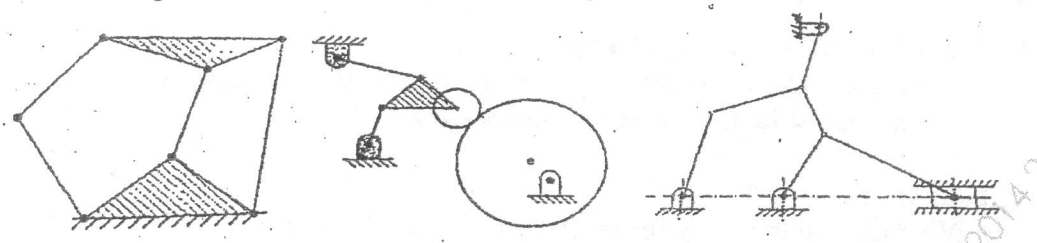
Con. 12209-14.

(b) Find the degree of freedom for the following mechanisms as shown in the figure, 6



4. (a) The centre to centre distance between the two sprockets of a chain drive is 600 mm. The chain drive is used to reduce the speed from 180 rpm to 90 rpm. The driving sprocket has 18 teeth and a pitch circle of 480 mm. Determine the number of teeth on the driven sprocket, pitch and length of the chain. 7

(b) Two 20° involute spur gear mesh externally and give a velocity ratio of 3. Module is 3 mm and the addendum is equal to 1.1 times module. If pinion rotates at 120 rpm determine the number of pair of teeth in contact. 7

(c) Derive the equation for centrifugal tension with respect to belt drive. What is its effect on power transmission ? 6

5. (a) A cord is wrapped around a solid cylinder of radius 'r' and mass 'm'. The cylinder is released from rest. Determine the velocity of its centre of mass after it has moved down a distance 'h'. 7

(b) With the help of a neat sketch explain law of gearing. 7

(c) What do you mean by Coriolois component of acceleration ? Draw its different direction. 6

6. Differentiate between the following :— 20

(a) Belt drive and chain drive.
(b) Involute and cycloidal gear tooth profile.
(c) Ackerman and Davis steering gear mechanism.
(d) Machine and structure.

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S.E. M.E. Sem-IV – CBSGS. 10/6/2014

M.T.

QP Code : **NP-19824**

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

N. B. : (1) Question **No. 1** is **compulsory**.
(2) Attempt **any three** questions from remaining five questions.
(3) Draw neat well labeled sketches.
(4) Figures at **right** side indicate marks.

1. Write note on any **four**:- **20**
   (a) Flame Hardening
   (b) Composite materials
   (c) Classify crystal imperfections
   (d) Normalising
   (e) Allotropic forms of iron
   (f) Classification of engineering materials.

2. (a) What is Dislocation? What are the sources of Dislocation? Compare edge and screw Dislocation. **10**
   (b) What is plastic deformation? Discuss how plastic deformation of single crystal takes place by slip mechanism and twinning mechanism. **10**

3. (a) State Griffith theory of brittle fracture. On its basis, derive an expression for fracture stress. State Orowan's modification. **10**
   (b) How creep test is carried out? Explain Andrade's analysis of creep. **10**

4. (a) What is Fatigue limit explain with S-N curve? Explain fatigue testing. **10**
   (b) What is hardenability? Explain Jominy End Quench test method to measure hardenability. **10**

5. (a) Define 'Alloy'. Name different types of alloys. Discuss Hume-Rothery conditions of formation of solid solution. **10**
   (b) Draw $Fe\text{-}Fe_3C$ Diagram and Explain Eutectoid, Eutectic and Peritectic transformation in the $Fe\text{-}Fe_3C$ Diagram. **10**

6. (a) Draw a neat Time Temperature Transformation (TTT) and CCT of 0.8% carbon steel and label all important points and phases. **10**
   (b) Write short note on: **10**
      (i) Nanomaterials
      (ii) Effect of alloying element on Fe-C diagram.

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Con. 13332-14.

SE- Mechanical.
Sem IV (CBSGS)
PP - II

04/06/2014

QP Code : NP-19785

(3Hours) [Total Marks :80

N.B.:— (1) Question no. **1** is **compulsory.**
(2) **Attempt** any **three** questions out of **remaining five** questions.
(3) Assume suitable data if **necessary.**

1. Attempt any **five** of following:— **20**
   (a) Explain shaping machine with neat diagram.
   (b) Differentiate between open loop and closed loop systems in CNC machines.
   (c) Draw two dimensional tool dynamometer and explain its features.
   (d) Show that in metal cutting $Vc=V \times rc$
   (e) Write a note on lubrication effects of cutting fluids.
   (f) Explain orthogonal rake system in detail.

2. (a) Explain the design procedure for a broach tool with help of diagram. **10**
   (b) Write a note on cutting tool materials. **10**

3. (a) With the help of neat sketch describe vertical machining centres. **10**
   (b) Derive an expression for optimum cutting speed and tool life for minimum cost and maximum production rate. Also show that optimum cutting speed for maximum production rate is always more than optimum cutting speed for minimum cost. **10**

4. (a) In an orthogonal cutting setup, the depth of cut was 10 mm, feed =1mm/Rev: cutting spped is 60 r.p.m. back rake angel =10°, chip thickness ratio=0.33, shear stress of material at zero compressive stress =1000kg/sq.cm. Assume that value of constant 'K' in equation $2\phi+\beta-\alpha=\cot^{-1} k$, is 0.2. Calculate the resultant force, rate of metal removal. Shear strain, H.P at the tool per cubic cm of metal removal/ minute. **10**
   (b) Explain milling machines in detail. **10**

5. (a) How is gear manufacturing done? Explain in detail. **10**
   (b) Derive the original Merchants theory along with diagram and assumption. **10**

6. Write short notes on:— **20**
   (a) Tool wear.
   (b) Form tool design.
   (c) G.M, codes in C.N.C. machines.
   (d) Carbide tool inserts.

S.E. M.E. Sem-IV - CBSGS 16/06/2014
I.E.

QP Code : NP-19862

(3 Hours) [Total Marks :80

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

1. Solve any **five**:— 20
   (a) SCR is a semi-controlled device-Justify
   (b) Enlist applications of
      (i) Rectifier diode
      (ii) Zener diode
      (iii) Light emitting diode
      (iv) Photo diode
   (c) Explain use of
      (i) Multiplexer
      (ii) De-multiplexer
      (iii) Boolean algebra
      (iv) Encoder.
   (d) Discuss effect of R-L & R-L-E load on full wave rectifier operation.
   (e) Compare AC and DC motors.
   (f) Mention power consumption of MSP430 in different operating modes.
   (g) Explain applications of BLDC motor & servomotor.

2. (a) Explain any one application circuit of TRIAC-DIAC with wavefrom. 7
   (b) Draw different circuits of full wave controlled rectifier with R-load & calculate fining angle at which fully controlled full wave rectifier is to be operated to get output dc voltage of 110V from input voltage of 230V, 50 Hz. 7
   (c) Explain register related to configuration of digital input/output port of MSP 430 microcontroller. 6

3. (a) Draw circuit diagram and waveform of 3-phase bridge inverter with R-load (180^0 mode of conduction) 7
   (b) Explain frequency control scheme of 3-phase induction motor with the help of block diagram. 7
   (c) Draw the circuit diagram and write the output voltage equation of inverting amplifier and summing amplifier. 6

4. (a) Explain IC555 astable multivibrator. 7
   (b) Explain functional block diagram of MSP430 microcontroller. 7
   (c) Draw and explain block diagram of closed loop speed control of DC motor (with inner current loop) 6

5. (a) Discuss interfacing of 3V system with 5V system and heavy loads like motors. 7
(b) Write a short note on 'selection of motor & power rating for a pump'. 7
(c) Discuss accuracy, resolution and least significant bit regarding 10-bit ADC. 6

6. Compare the following:—
(a) Power transistor, SCR, MOSFET and IGBT. 7
(b) Microprocessor and microcontroller. 7
(c) TTL and CMOS technology. 6

SE - CE & ME

A·M·IV (Rev) 19·5·14

Q P Code : NP-19673

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

N.B. : (1) Question **No. 1** is **compulsory.**
(2) **Solve** any **three** questions out of **remaining.**
(3) **Each** question carries **equal** marks.
(4) **Use** of **statistical tables** is **allowed.**

1. (a) Find a, b, c if $\bar{F} = (axy + bz^3)\bar{i} + (3x^2 - cz)\bar{j} + (3xz^2 - y)\bar{k}$ is irrotational. **5**

(b) Find $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ interms of A using Cayley-Hamilton theorem **5**

for $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$

(c) A continuous random variable X has the p.d.f. defined by $f(x) = A + Bx$, $0 \le x \le 1$. **5**

if the mean of the distribution is $\frac{1}{3}$ find A and B.

(d) A sample of 50 pieces of certain type of string was tested. The mean breaking strength turned out to be 14.5 pounds. Test whether the sample is from a batch of a string having a mean breaking strength of 15.6 pound and S.D. of 2.2 pounds. **5**

2. (a) Obtain the rank correlation coefficient from the follwoing data :— **6**

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

(b) The marks of 1000 students of university are found to be normally distrubuted with mean 70 & SD 5. Estimate the number of students whose marks will be (i) between 60 & 75 (ii) more than 75. **6**

(c) Show that the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ is diagonalisable. **8**

Find the diagonal form and transforming matrix.

3. (a) A certain injection administered to 12 patients resulted in the following changes of blood pressure : **6**
5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the injection will be in general accompanied by an increase in blood pressure?

(b) Optimize $Z = x_1^2 + x_2^2 + x_3^2 - 6x_1 - 8x_2 - 10x_3$ **6**

(c) Verify Green's theorem in the plane for **8**

$\oint (x^2 - y)dx + (2y^2 + x)dy$

around the boundary of the region defined by $y = x^2$ and $y = 4$.

4. (a) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used (ii) some demand is refused. 6

(b) Evaluate $\iint_S (\nabla \times \bar{F}) \cdot d\bar{s}$ where 6

$\bar{F} = (2x - y + z))i + (x + y - z^2)j + (3x - 2y + 4z)k$ and S is the surface of the cylinder $x^2 + y^2 = 4$ bounded by the plane $Z = 9$ and open at the other end.

(c) Table below shows the performances of students in Mathematics and Physics. Test the hypothesis that the performance in Mathematics is independent of performance in physics. 8

Grades in Physics	Grades in Maths		
	High	Medium	Low
High	56	71	12
Medium	47	163	38
Low	14	42	81

5. (a) The ratio of the probability of 3 successes in 5 independent trials to the probability of 2 successes in 5 independent trials is ¼. What is the probability of 4 successes in 6 independent trials? 6

(b) Evaluate $\iint_S \bar{F}.d\bar{s}$ where $\bar{F} = 4xi - 2y^2j + z^2k$ and S is the region bounded by 6

$y^2 = 4x$, $x = 1$, $z = 0$, $z = 3$.

(c) Find (i) the lines of regression (ii) coefficient of correlation for the following data. 8

X	65, 66, 67, 67, 68, 69, 70, 72
Y	67, 68, 65, 66, 72, 72, 69, 71

6. (a) A group of 10 rats fed on diet A and another group of 8 rats fed on different diet B, recorded the follwoing increase in weight 6

Diet A : 5, 6, 8, 1, 12, 4, 3, 9, 6, 10gms

Diet B : 2, 3, 6, 8, 1, 10, 2, 8 gms

Find if the variances are significantly different?

(b) If $A = \begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$ then prove that $3 \tan A = A \tan 3$. 6

(c) Using the kuhn-Tucker conditions solve the follwoing N.L.P.P. 8

Maximize $Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$

Subject to $x_1 + x_2 \leq 2$

$2x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$