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AUTO

Sub: - IE

Date: - 16/6/14

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:—

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- (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 waveform. 7
- (b) Draw different circuits of full wave controlled rectifier with R-load & calculate firing 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° 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
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SE SEM-IV (Rev) May-June-14

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Sub:- MT

Date:- 10/6/14

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-Fe₃C Diagram and Explain Eutectoid, Eutectic and Peritectic transformation in the Fe-Fe₃C 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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Sub: - PP-II

Date: 4/6/14

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 $V_c = V \times r_c$
 - (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: 10
 cutting speed is 60 r.p.m. back rake angle = 10° , chip thickness ratio = 0.33, shear stress of material at zero compressive stress = 1000 kg/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.
 (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.

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Sub:- Tom-I

Date: 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 :—

- What do you mean by initial tension in belt drive ?
- With the help of a simple four bar mechanism explain the types of instantaneous centres.
- Explain the term pressure angle with respect to a cam mechanism. What are the methods to control it ?
- Explain the types of constrained motions.
- With the help of a neat sketch explain Grasshopper's mechanism.

20

2. (a) A cam with a minimum radius of 25 mm is to be designed for a knife edge follower 14
 with the following data :—

- to raise the follower through 35 mm during 60° rotation of the cam.
- dwell for the next 40° of the cam rotation.
- descending of the follower during the next 90° of the cam rotation.
- dwell during the rest of the cam rotation.

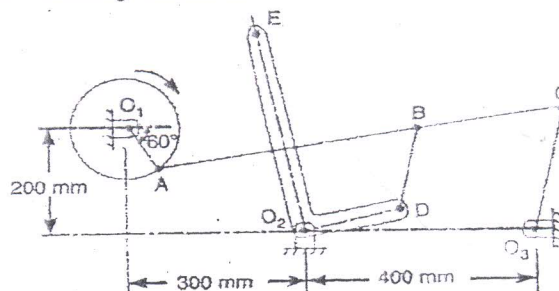
if the ascending and descending of the cam is with SHM and UARM respectively.
 Draw the displacement, velocity, acceleration and jerk diagram if the cam rotates at 150 rpm.

(b) The universal coupling is used to connect two shafts together. The input shaft 6
 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.

3. (a) The mechanism of a wrapping machine as shown in the figure has the following 14
 dimensions :—

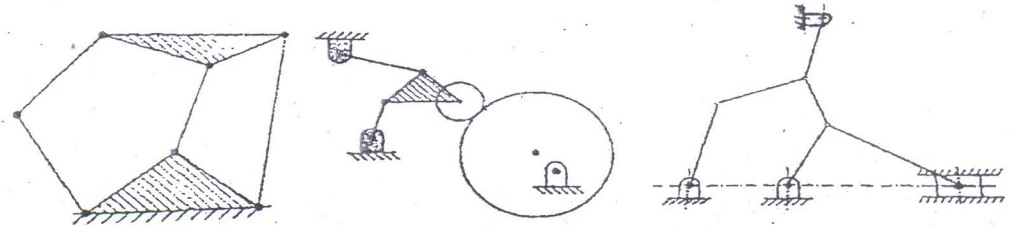
$O_1A = 100$ mm; $AC = 700$ mm; $BC = 200$ mm; $O_3C = 200$ mm; $O_2E = 400$ mm;
 $O_2D = 200$ mm and $BD = 150$ mm. The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of the point E of the bell crank lever by :

- Instantaneous centre method.
- Relative velocity method.



[TURN OVER]

- (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 Coriolis component of acceleration? Draw its different direction. 6
6. Differentiate between the following :— 20
- Belt drive and chain drive.
 - Involute and cycloidal gear tooth profile.
 - Ackerman and Davis steering gear mechanism.
 - Machine and structure.

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SE SEM-IV (REV) May-June-14

Sub: AM-IV

Date: 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 $\vec{F} = (axy + bz^3)\vec{i} + (3x^2 - cz)\vec{j} + (3xz^2 - y)\vec{k}$ is irrotational. 5
(b) Find $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ in terms 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 $f(x) = A + Bx$, $0 \leq x \leq 1$. 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 following 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 distributed 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 $y = 4$.

Con. 10152-14.

TURN OVER

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.

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

$\vec{F} = (2x - y + z)\vec{i} + (x + y - z^2)\vec{j} + (3x - 2y + 4z)\vec{k}$ 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.

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 $\frac{1}{4}$. What is the probability of 4 successes in 6 independent trials?

- (b) Evaluate $\iint_S \vec{F} \cdot d\vec{s}$ where $\vec{F} = 4x\vec{i} - 2y^2\vec{j} + z^2\vec{k}$ and S is the region bounded by $y^2 = 4x$, $x = 1$, $z = 0$, $z = 3$.

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

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 following increase in weight

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 $3 \tan A = A \tan 3$.

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

$$\text{Maximize } Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$$

$$\text{Subject to } \begin{aligned} x_1 + x_2 &\leq 2 \\ 2x_1 + 3x_2 &\leq 12 \\ x_1, x_2 &\geq 0 \end{aligned}$$