SE-ME (IV-old)
TOM - I

Backup

(OLD COURSE)   QP Code : **MV-18825**

(3 Hours)   [Total Marks : 100

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

(2) Attempt any four out of remaining six questions.

(3) Assume suitable data if necessary.

(4) Figures to the right indicate full marks.

1. Explain any **four** :-   20

    (a) Classification of kinematic pair.

    (b) Law of Gearing

    (c) Rubbing velocity at pin joint.

    (d) Peaucellier's Mechanism.

    (e) Open and cross belt drives.

2. (a) Describe Hart's mechanism with a neat sketch and prove that the tracing point   6
describes a straight line path.

    (b) In a mechanism shown in **Fig. 1**, the crank OA is 100mm long and rotates   14
clockwise about 0 at 120 r.p.m. The connecting rod AB is 400mm long. At a
point C on AB, 150mm from A, the rod CE 350mm long is attached. This rod
CE slides in a slot in a trunnion at D. The end E is connected by a link EF,
300mm long to the horizontally moving slider F.

    For the mechanism in the position shown, Find :-

       (i) Velocity of F and velocity of sliding of CE in the trunnion by ICR
method.

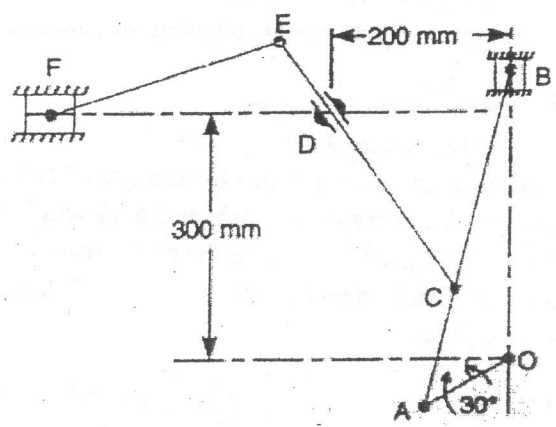   (ii) Angular velocity of CE by Relative Velocity method.

Fig. 1

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3. (a) Explain all directions of Coriolli's Component of acceleration. 5

   (b) One of the valve gear mechanisms is shown in **Fig. 2**. $A_1P = 5$cm, 15
   $PQ = 14$ cm, $PR = 16.5$ cm, $RV = 12$ cm and $QA_2 = 17$ cm. For the given
   configuration find the velocity and acceleration of the valve rod V when the
   crank A_1P rotates at constant speed of 12 rad/sec in anticlockwise direction.
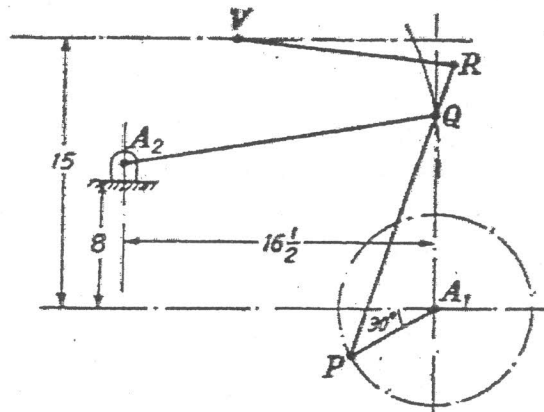   All dimensions are in cm.

Fig. 2

4. (a) Derive an expression for maximum efficiency of Helical gear pair in mesh at 8
   any instant.

   (b) In a slider crank mechanism, the length of stroke is 120 mm connecting rod is 12
   250 mm long. When the crank rotates at 2000 rpm and has travelled 60° from
   dead centre. Find :-
   (i)   Displacement of piston.
   (ii) Velocity and acceleration of piston.
   (iii) Angular velocity and acceleration of connecting rod.

5. (a) Explain chordal action in chains. 5

   (b) Describe Double Hook's Joint. 5

   (c) A belt embraces the shorter pulley by an angle of 165° and runs at a speed of 10
   1700 m/min. The width is 200 mm and thickness is 8mm. Density of belt
   material is 1000 kg/m^3. Determine the max. power that can be transmitted if
   the max. permissible stress is not to exceed 2.5 N/mm^2 and co-efficient of
   friction 'μ' is 0.25.

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6. (a) Explain 'Work - Energy Principle'.   5

     (b) With the help of neat sketch describe 'Pantograph'.   5

     (c) The turning moment diagram for a four stroke gas engine may be assumed to 10
        be represented by four triangles, the areas of which from the line of zero
        pressure are as follows :-

            Suction stroke $= 0.45 \times 10^{-3} \text{ m}^2$,

            Compression stroke $= 1.7 \times 10^{-3} \text{ m}^2$;

            Expansion stroke $= 6.8 \times 10^{-3} \text{ m}^2$;

            Exhaust stroke $= 0.65 \times 10^{-3} \text{ m}^2$.

            Each m^2 of area represents 3MN-m of energy.

        Assuming the resisting torque to be uniform find the mass of the rim of a
        flywheel required to keep the speed between 202 and 198 r.p.m. The mean
        radius of the rim is 1.2m.

7. (a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the 10
        gears is involute with 20° pressure angle, 12mm module and 10mm addendum.
        Find the length of path of contact, arc of contact and contact ratio.

     (b) Derive an expression for condition for correct steering in Davis steering gear 10
        mechanism.

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(OLD COURSE)   **QP Code : MV-18940**

Total Marks: **100**
Total Time: **3 Hrs**

Instructions:
1. Question No: 1 is compulsory.
2. Answer any four from the remaining six questions
3. Figures to the right indicate full marks.

1.   **Solve any four:-**   (20)
   a) Explain SCR I-V characteristics on basis of modes of operation.
   b) Compare series and parallel inverters.
   c) What are the advantages of electronic control in speed control?
   d) Enlist specifications any one practical OPAMP .
   e) State and prove De Morgan's theorem.

2. a) Explain the significance two transistor analogy of SCR and how it is   (10)
        implemented as SCR?
   b) What do you mean by commutation of SCR? Classify and explain   (10)
        commutation circuits of SCR.

3. a) How light deemer is achieved using DIAC and TRIAC control   (10)
        circuit?
   b) Classify choppers circuits using SCR and derive expression for step   (10)
        up chopper.

4. a) Discuss in detail the over-voltage protection of DC motor.   (10)
   b) Why AC drives is the upcoming field? Explain any one three phase   (10)
        induction motor speed control.

5. a) Explain 555 timer as astable multivibrator with waveforms.   (10)
   b) Realize all basic gates with NAND and NOR universal gates.   (10)

6. a) Prove that OPAMP circuit acts as an integrator..   (10)
   b) Explain the role of K-map reduction technique and prove it with an   (10)
        example.

7. a) Explain architecture of 8085 microprocessor   (10)
   b) Write a detailed note on Jone's chopper.   (10)

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(OLD COURSE)   QP Code : MV-18864

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

NOTE:

- Question No 1 is **COMPULSORY**.
- Attempt any **FOUR** questions out of remaining **SIX** questions.
- Assume suitable data wherever required.
- Illustrate answers with sketches wherever required.
- Use of steam table, Gas table and Mollier chart is permitted.

1. Solve the following (**any FIVE**)   20
   (a) Write any four applications of gas turbine.
   (b) Differentiate between single stage and multistage air compressors.
   (c) Explain the working principle of impulse steam turbines.
   (d) Define higher and lower calorific values of fuel.
   (e) Differentiate between jet and surface condensers (four points.)
   (f) Classify the different types of boilers (four types).

2. (a) Explain the construction & working of simple vertical boiler with the help of neat sketch.   10
   (b) A single acting two stage reciprocating air compressor handles 4.5 kg of air per minute and compresses it from 1.013 bar and 17 °C through a pressure ratio of 9. The index of compression and expansion in both stages is 1.3. Clearance volume of the both the stages are 5% of their respective swept volume and compressor runs at 300 rpm. Assume intercooling is complete. Determine (i) Indicated Power (ii) swept volume of LP and HP cyclinder.   10

3. (a) Determine enthalpy of combustion (in kJ/kg of fuel) of liquid octane (C_8H_{18}) at 25°C and 1 atm. Assume the water in the products is in the liquid form. The enthalpy of formation data at 25°C and 1 atm is as follows: CO_2 = –393,520 kJ/kmol; $H2O(\ell)$ = –285,830 kJ/kmol; C_8H_{18} (ℓ) = –249,950 kJ/kmol. Take M = 114 kg/kmol.   10
   (b) Explain Standard reference state, enthalpy of reaction and Enthalpy of formation.   06
   (c) Write applications of compressed air.   04

4. (a) A steam generator evaporates 18000 kg/h of steam at 12.5 bar and a quality of 0.97 dry from feed water at 105 °C when coal is fired at 2040 kg/h. If higher calorific value of coal is 27400 kJ/kg find: (i) heat rate of the boiler (ii) equivalent evaporation (iii) thermal efficiency.   12
   (b) Define volumetric efficiency and prove that $\eta_{vol} = 1 + k - k\left(\dfrac{P_2}{P_1}\right)^{1/n_e}$ where each term has its usual meaning.   08

5. (a) At a particular stage of 50% reaction turbine, the pressure is 1.4 bar & steam is 0.9 dry. The inlet and outlet angles are 35° and 20° respectively. The blade velocity is 67 m/s. Determine the blade height, if the ratio of drum diameter to blade height is 8 for a mass flow rate of 4.5 kg/s. Also find power developed.   12
   (b) Explain gas turbine cycle with reheat with the help of Schematic and T-S diagram.   08

6. (a) In a constant pr open cycle gas turbine power plant, air is compressed from 1 bar and 20 °C through a pressure ratio of 5. It is then heated to 680 °C in the combustion chamber. Pressure loss in combustion chamber is 0.1 bar. Isentropic efficiency of turbine and compressor is 85% & 80% respectively and combustion efficiency is 85%. Calculate (i) mass of air if plant develops 1065 kW (ii) heat supplied /kg of air (iii) thermal efficiency. Take Cp for gas & air = 1.024 kJ/kgK and γ = 1.4. Neglect mass of fuel.   12
   (b) Explain evaporative steam condenser with neat sketch.   08

7. Write short notes on any **FOUR**:   20
   (a) Fusible Plug   (d) Features of high pressure boiler.
   (b) Adiabatic flame temperature.   (e) Boiler mountings for safety and control.
   (c) Need of compounding of steam turbine.   (f) Open cycle gas turbine.

SE-Mechanical
sem IV (old)
P. P. -II
(OLD COURSE)

04/06/2014

QP Code : MV-18901

(3 Hours) [Total Marks : 100]

N.B. : (1) Question No. 1 is **compulsory**.
    (2) Attempt any **four** from remaining **six** questions.
    (3) **All** questions carry **equal** marks.
    (4) Missing data can be **suitably** assumed.

1. Attempt any **four** :—   20
    (a) Describe the principles of pin location
    (b) Explain the principle of metal shearing
    (c) Discuss various types of tool wears
    (d) Describe tool life
    (e) Write a note on gear forming.

2. (a) What error is caused by the improper orientation of a V locator ?   10
    (b) Differentiate between a "Drop through" and "Inverted" blanking die ?   10

3. (a) How can rotation and lifting of drill bushing be prevented.   5
    (b) Describe he degree of freedom of a work-piece located in space ?   5
    (c) What are the functions of providing 'straight and angular clearenece' in die block ?   5
    (d) What is meant by 'Clearence' in die block and punch ? Why it is important in shearing operation ?   5

4. (a) In orthogonal cutting test with a tool of rake angle 10°, the following observations were made;   12
    Chip thickness ratio = 0·37
    Horizontal Component of cutting force = 1000N
    Vertical component of the cutting force = 1500N
    From Merchant's theory, Calculate the various components of the cutting forces and the coefficient of friction at the chip tool interface.
    (b) How do you define tool life ? Explain the parameters that control the tool life of a single point cutting tool.   8

5. (a) Why a gear hobbing machine is more productive then a gear shapping ?   8
    (b) How is the pitch of teeths of a borach selected ?   7
    (c) Write a note on cutting fluids.   5

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6. (a) Sketch the internal round broach and write briefly on the following elements.
    (i) Rake and relief angles
    (ii) Depth of cut per tooth
    (iii) Width of land.

   (b) Write steps of designing form tool by graphical method. Design and draw a circular
   form tool having
       Maxim radius = 60 mm
       Minimum radius = 40 mm
       Rake and Relief angle as 10° and 6° respectively.

7. Answer in brief any **four** :—
    (a) Extrusion of metals
    (b) Lathe tool mechanical dynamometer
    (c) Defects in sheet rolling process
    (d) Types of rolling mills
    (e) Advantages limitations and applications of forging.

(OLD COURSE)   QP Code : **MV-18792**

(3 Hours)   [Total Marks : 100

N.B. : (1) Questions No. 1 is **compulsory**.

(2) Attempt any **four** questions from the remaining **six** questions.

(3) **Figures** to the **right** indicate **full** marks.

1. (a) Find the fourier series for $f(x) = 1-x^2$ in $(-1,1)$ 5

(b) If 10 fair coins are tossed simultaneously, what is the chance of getting atleast 7 heads?   5

(c) The equations of the two regression lines are $3x + 2y = 26$ and $6x + y = 31$ find $\bar{x}, \bar{y}$ and r   5

(d) Derive wave equation for vibration of string   5

2. (a) A random variable X has the probability distribution   6

x :	-2	-1	0	1	2	3
P (X = x) :	0.1	K	0.2	2k	0.3	k

Find K, mean and variance of X

2. (b) In a certain factory turning out blades, threre is a smull chance $\frac{1}{500}$ for any blade to be defective. The blades are supplied in packets of 10. Use the poission distribution to calculate the approximate number of packets containing no defective, one defective, two defective blades in a consignment of 10,000 packets.   6

(c) Find the fourier series for $f(x) = x + x^2$ when $-\pi \leq x \leq \pi$ and deduce that   8

$$\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$$

3. (a) The marks obtained by students in a certain examination follow a normal distribution with mean 45 and standard deviation 10. If 1000 students appeared at an examination, calculate the number of students scoring (i) less than 40 marks (ii) more than 60 marks.   6

(b) Find the fourier expansion for $f(x) = \sqrt{1 - \cos x}$ in $(0, 2\pi)$ 6

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(c) An infinitely long uniform plate is bounded by two parallel edges and an end at right angle to them. The breadth is π, this end is maintianed at temperature u_0 at all points and other edges are at zero temperature. Determine the temperature $u(x,y)$ at any point of the plate in the steady state if u satisfies Laplace equation. 8

4. (a) Find half range cosine series for x in $0 < x < 2$. 6

(b) Fit a Bionomial distribution to the following data 6
| x : | 0 | 1 | 2 | 9 | 4 | 5 |
| f : | 12 | 56 | 74 | 69 | 18 | 1 |
also calculate the expected frequencies.

(c) Calculate the correlation coefficient from the following data 8
| x : | 23 | 27 | 28 | 29 | 30 | 31 | 33 | 35 | 36 | 39 |
| f : | 18 | 22 | 23 | 24 | 25 | 26 | 28 | 29 | 30 | 32 |

5. (a) A random sample of 50 items gives the mean 6.2 and standard deviation 10.24. Can it be regarded as drawn from a normal population with mean 5.4 at 5% level of significance? 6

(b) Find the fourier series for $f(x) = \cos px$ in $(O, 2\pi)$ where p is not an integer. 6

(c) A rod of length L has its ends A and B kept at 0^0c and 100^0c respectively until steady state condition prevail. If the temperature at B is reduced suddenly to 0^0c and kept so while that of A is maintained. Find the temperature $u(x,t)$ at a distance x from A at time t. 8

6. (a) Obtain the complex form of fourier series for $f(x) = \bar{e}^{ax}$ in $(-\pi,\pi)$ 6

(b) The number of car accidents in a metropolitan city was found to be 20, 17, 12, 6, 7, 15, 8, 5, 16 and 14 per month respectively. Use χ^2 - test to check whether these frequencies are in agreeement with the belief that occurrence of accidents was the same during 10 months period. 6

(c) Obtain both the times of regression for the following data. 8
| x : | 80 | 45 | 55 | 56 | 58 | 65 | 68 | 70 | 75 | 86 |
| f : | 82 | 56 | 50 | 48 | 60 | 64 | 65 | 70 | 74 | 90 |

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6

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7. (a) Show that the set of functions

$\sin (2n +1) x, n = 0, 1, 2 - - - -$ is orthogunal over $\left[0, \dfrac{\pi}{2}\right]$

6

6

(b) Express the function $f(x) = \begin{cases} \dfrac{\pi}{2} & \text{for} \quad 0 < x < \pi \\ 0 & \text{for} \quad x > \pi \end{cases}$

6

as fourier sine integral.

(c) A tightly streched string with fixed end points $x = 0$ and $x = L$, in the shape defined by $y = kx (L - x)$ where K is a constant is released from this position of rest. Find y (x, t), the vertical displacement if $\dfrac{\partial^2 y}{\partial t^2} = c^2 \dfrac{\partial^2 y}{\partial x^2}$

8

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