PAKISTAN ENGINEERING COUNCIL

Sample MCQs

Mechatronics Engineering

1. Please read all the instructions carefully and do not start the paper unless asked to do so.
2. Fill in your particulars (Name, Roll Number, PEC Registration Number, CNIC and Discipline) in BLOCK letters in the space provided.
3. You are not allowed to change your seat during the test.
4. Hand over your answer sheet to the invigilator at the end of each part and keep seated until allowed to leave the centre.
5. The examination is divided into three Parts viz Part-I, Part-II and Part-III, with 30 minutes break.
6. All questions are to be attempted and carry equal marks.
7. Passing marks for each part is 60%, and passing all three parts is mandatory to qualify EPE.
8. Use only the provided pencil to fill completely the correct choice circle on answer sheet.
9. Programmable calculator, laptop, mobile phone, iPod, and any storage device/electronic gadget are not allowed.
10. No extra sheet will be provided; any calculation may be worked out on the back of the paper.
11. No candidate is allowed to indulge in any Law and Order situation to affect the exam process, and responsible(s) will be disqualified.
12. Use of unfair means will also lead to disqualification.

Instructions for Part-I

This part is common to all disciplines, comprising 30 multiple choice questions of one mark each (Total Marks=30) with the duration of two hours.

Instructions for Part-II

This is a discipline based open book breadth examination, comprising 30 multiple choice questions of one mark each (Total Marks=30), with the duration of two hours.

Instructions for Part-III

This is a discipline based open book depth examination comprising 40 multiple choice questions of one mark each (Total Marks=40), with duration of three hours. The candidates will be allowed only for the specialized filed / area of practice, for which already applied at the time of application.

Mechatronics Engineering
Part-I

Total Marks: 30   **Total Time: 2 hours**

Name:	S/o, D/o, w/o:
Roll Number:	PEC Reg#:
CNIC:	Discipline:

- -

Q.1: Quality control is aimed at:

   a. Maintaining the desired quality
   b. Exceeding the desired quality
   c. Continuously improving the quality
   d. Following the quality

Q.2: Which of these is correct with respect to a product developed or a service performed?.

   a. Bad quality is acceptable, but bad grade is not.
   b. Bad grade is acceptable, but bad quality is not.
   c. Neither bad grade nor quality is acceptable.
   d. Grade and quality is the same thing.

Q.3: Project A has an internal rate of return (IRR) of 21 percent. Project B has an IRR of 7 percent. Project C has an IRR of 31 percent. Project D has an IRR of 25 percent. Which of these would be the BEST project?

   a. Project A
   b. Project B
   c. Project C
   d. Project D

Q.4: What characteristic best describes the cost baseline?

   a. Total budget for the project
   b. Time phased budget for the project
   c. Total budget for the project including the contingency budget
   d. Total budget for the project including the contingency budget and the management reserve.

Q.5: Present worth is:

    a. The discounted future cash flows to the present
    b. The compounding present cash flows to the future
    c. The current market value of the investment
    d. The opportunity cost at the present value.

Q.6: The first preferred way to resolve a dispute between the contracting parties is:

    a. Arbitration
    b. Litigation
    c. Negotiation
    d. Mediation

Q.7: Following document define the legal rights and obligations of the parties and may be described as the regulations under which the contract will be performed.

    a. Specifications
    b. General Conditions of Contract
    c. Special provisions
    d. Bill of Quantities

Q.8: The minimum notice period for National Competitive bidding is:

    a. 30 days
    b. 45 days
    c. 35 days
    d. 15 days

Q.9: Tsunamis' is generated by:

    a. Earthquake
    b. Air currents
    c. Tidal waves
    d. Large Ocean waves

Q.10: Globalization has direct impact on:

    a. National security
    b. Economy
    c. Society
    d. All above

Q.11: The passive voice for the sentence "He is writing a letter" is;

    a. A letter is wrote by him
    b. A letter is written by him
    c. A letter is being written by him
    d. A letter is been written by him

Q.12: Choose the correct sentence

    a. He is elder than me
    b. He is older than me
    c. He is ager than me
    d. He is older than I

Q.13: Effective communication is

    a. The transfer of message from sender to receiver
    b. Sending of massage
    c. Receiving of message
    d. The transfer of message from sender to receiver and get the desired response.

Q.14: Body language is form of;

    a. Personality and attitudes
    b. Non verbal communication
    c. Individual preference for expression
    d. The body expression

Q.15: Project feasibility report is aimed at;

    a. Informing the people
    b. Attracting the customer
    c. Justifying the investment
    d. Giving details of resources

Q.16: Research Proposal synopsis is developed at;

    a. Final stage of research
    b. Initial stage of research
    c. Before approval of research proposal
    d. In the middle of research

Q.17: Project monitoring is required:

    a. Before commencement of the project
    b. During implementation of the project
    c. After completion of the project
    d. At any stage of the project deemed necessary

Q.18: Re-appropriation Statement is form of

    a. Progress report
    b. Budget report
    c. Financial report
    d. Normal report

Q.19: PC-III (A) is used for

a. For weekly progress report of public sector projects
b. Monthly progress report of public sector projects
c. Yearly progress report of public sector projects
d. Quarterly progress report of public sector projects.

Q.20: Acquiring management and leadership skills are _____ for a Professional Engineer

a. Wastage of time
b. Not important
c. Highly important
d. Not necessary

Q.21: Engineering ethics refers to:

a. The rules and standards given by an institution for Engineering practice
b. The rules and regulation relating to obligations and rights of others.
c. The professional regulation
d. The rules and standards which govern the conduct of Engineers as professional Engineers.

Q.22: How many commandments are given in PEC Code of Ethics?

a. 20
b. 30
c. 10
d. 05

Q.23: As per PEC Code of Conduct a member shall report unethical professional practices of an engineer or a member with substantiating data to

a. Court of Law
b. Concerned Department
c. Pakistan Engineering Council
d. Law enforcing Agency

Q.24: When a member uses designs, plans, specifications, data and notes supplied to him by a client or an employer or are prepared by him in reference to such client or the employer's work such designs, plans, specifications, data and notes shall remain the property of the _____and shall not be duplicated for any use without the express permission of the _____.

a. Member, Member
b. Client, Client
c. Member, Client
d. Client, Member

Q.25: As per PEC Code of Conduct to maintain, uphold and advance the honor and dignity of the engineering professional, a member shall do following except:

a. uphold the ideology of Pakistan
b. be honest, impartial and serve the country, his employer, clients and the public at large with devotion.
c. Uphold personal interest first
d. use his knowledge and skill for the advancement and welfare of mankind

Q.26: Conflicts are faced when:

a. There are more than one expected outcomes
b. There are more than one expected benefits and losses
c. There is choice between two or more moral values each having its own merits.
d. There are opposing outcomes.

Q.27: An example of a conflict of interest would be:

a. As a responsible official you make a decision about a contract award that will benefit you personally
b. You and a functional manager disagree with a task cost estimate
c. Your sponsor decides to cancel your project because it no longer supports the company strategy
d. Your personality conflicts with that of a key member of your project team.

Q.28: Adherence to professional ethics is _____ an engineer to society.

a. Not obligation of
b. An obligation of
c. Optional for
d. None of above

Q.29: While designing a project by an engineer, _____should be taken into account to protect cultural heritage

a. All possible alternates
b. No protection
c. Minimum protection
d. No care

Q.30: Close interpersonal relationships are characterized by high intimacy whereas distressed relationships tend to involve reciprocation of _____behaviour.
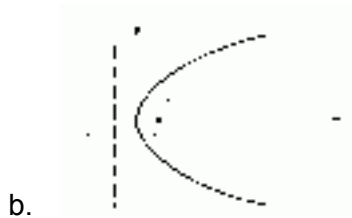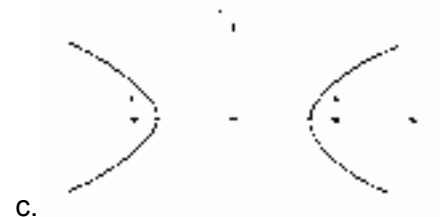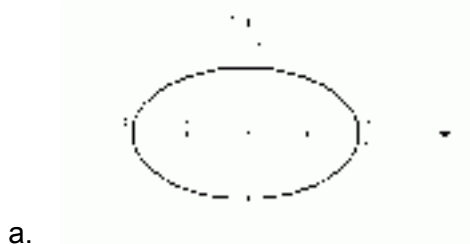
a. positive
b. negative
c. normal
d. casual

Answers:

1. a
2. b
3. c
4. b
5. a
6. c
7. a
8. d
9. a
10. d
11. c
12. b
13. d
14. b
15. c
16. c
17. b
18. c
19. b
20. c
21. d
22. c
23. c
24. b
25. c
26. c
27.
28. b
29. a
30. b

Part-II (Breadth of discipline)

Total Marks: 30   **Total Time: 2 hours**

Q.1: Which of the following is a hyperbola ?

a.

c.

b.

d. None of the above

Q.2: Integrating $\int \frac{\ln\left(\frac{1}{x}\right)}{x^2} dx$ will result in

    a. $\frac{1}{x}\ln\left(\frac{1}{x}\right) - \frac{1}{x} + c$

    b. $\frac{1}{x} + c$

    c. $-\left(\frac{1}{x}\ln\left(\frac{1}{x}\right) - \frac{1}{x}\right) + c$

    d. None of the above

Q.3: An $n \times n$ matrix is said to be symmetric if;

    a. If it is equal to its transpose

    b. If its determinant is equal to zero

    c. If it is of 2nd order

    d. None of the above

Q.4: Mathematically, what is a differential?

    a. A technique used for mathematical modeling.

    b. A method of directly relating how changes in an independent variable affect changes in a dependent variable.

    c. A method of directly relating how changes in a dependent variable affect changes in an independent variable.

d. None of the above

Q.5: The maximum current will pass through

a. Resistance
b. Inductance
c. Capacitance
d. None of above

**Q.6:** An element which consumes energy instead of storing in it is

a. Resistor
b. Inductor
c. Capacitor
d. Conductor

Q.7: A 1000W heater is rated to operate at a direct current (DC) of 10A. If the heater is supplied alternating current (AC) for producing the same quantity of heat the value of current should be

a. Iav=10A
b. Irms=10A
c. Ipeak=10A
d. Irms=10√2A

Q.8: A fixed resistance 'R' is connected across a dc voltage source. If the voltage is gradually and uniformly increased, the relationship between V and R is correctly represented in which group

a. Fig(A)
b. Fig(B)
c. Fig(C)
d. Fig(D)
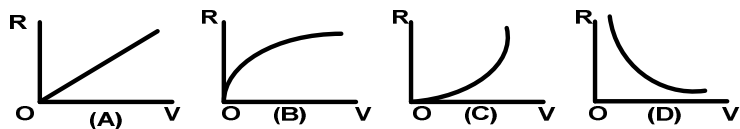
Q.9: The effects due to electric current are:

    I.   Magnetic effect
   II.   Heating effect
  III.   Luminous effect

Application working on which effect can be used on AC as well as DC supply?

a. I only
b. II only
c. II and III only
d. I, II only

Q.10: The root locus of a unity feed-back system is shown in fig. The open loop transfer

function is given by:

a. k/s(s+1)(s+2)
b. k(s+1)/s(s+2)
c. k(s+2) / s(s+1)
d. ks / (s+1) (s+2)

**Q.11:** A certain common-emitter amplifier has a voltage gain of 100. If the emitter bypass capacitor is removed.

a. The circuit will become unstable
b. The voltage gain will decrease
c. The voltage gain will increase
d. The circuit will become stable

Q.12: A Darlington transistor connection provides a transistor having a very large

a. Current gain
b. Voltage gain
c. Impedance gain
d. Impedance matching gain

Q.13: What is wrong with this circuit?

a. The zener is open
b. The zener is shorted
c. Nothing
d. Not enough data
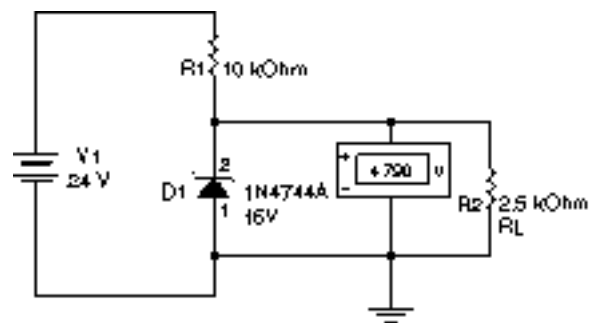
**Q.14:** An oscillator that uses a tapped coil to obtain the feedback is called:

a. A Hartley circuit
b. A Pierce circuit

c. A multivibrator

d. A negative feedback circuit

Q.15: If the output filter capacitor in a power supply actually had a value twice its stated value, which of the following symptoms would be found?

a. The output voltage would be doubled and a small improvement in the ripple voltage would be detected.

b. The ripple voltage would be half of what is expected and a small increase in the output voltage would be detected.

c. The output and ripple voltage would be greater than expected.

d. The output and ripple voltage would be less than expected.

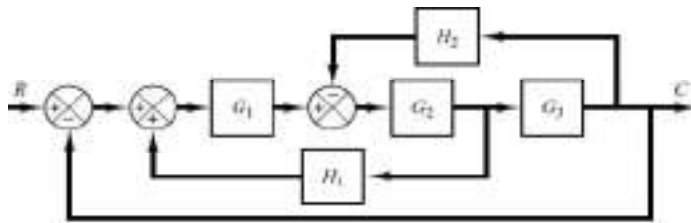**Q.16:** What is the simplified version of the signal flow graph represented below?
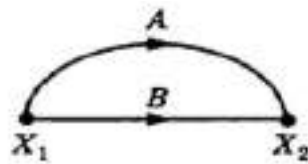
a.)

b.

c.

d.

Q.17: Consider the Bode Plot of a system shown below. Find the Gain Margin?
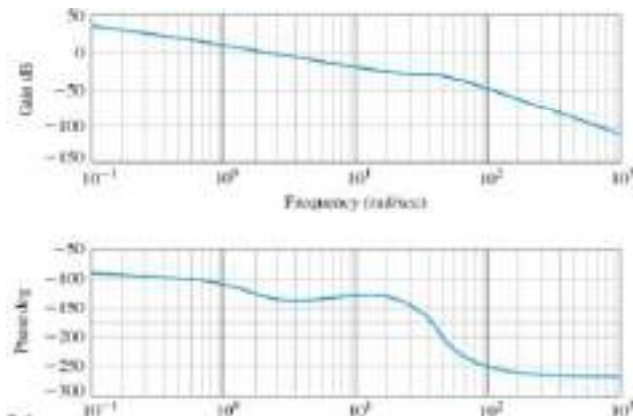
a.	50	b.	20
c.	30	d.	10

Q.18: Consider a control system shown below. Its simplified model will be?

a.

$$\frac{G_1 G_2 G_3}{1 - G_1 G_2 H_1 + G_2 G_1 H_2 + G_1 G_2 G_3}$$

b.

$$\frac{G_1 G_2 G_3}{1 - G_1 G_3 H_1 + G_2 G_3 H_2 + G_1 G_2 G_3}$$

c.

$$\frac{G_1 G_2 G_3}{1 - G_1 G_2 H_1 + G_1 G_3 H_1 + G_1 G_2 G_3}$$

d.   None of the above

Q.19: The spectrum of discrete-time Fourier transform will be:

a. Periodic and discrete
b. Aperiodic and continuous
c. Periodic and continuous
d. Aperiodic and discrete

Q.20: Frequency is inherently a physical quantity with characteristics.

    a. Positive

    b. negative

    c. both a &b

    d. none of above

Q.21: If x (n) = {1, 2, 5,7, 0, 1} then its region of convergence (ROC) will be:

    a. Entire plane

    b. Entire plane except Z=0

    c. Entire plane except Z=0 and Z= ∞

    d. None of the above

Q.22: Which losses in a transformer varies significantly with load

    a. Hysteresis losses

    b. Eddy current losses

    c. Copper losses

    d. Core losses

Q.23: Consider the circuit shown in the given figure. For maximum power transfer to the load, the primary to secondary turn's ratio must be

    a. 9 : 1

    b. 3 : 1

    c. 1 : 3

    d. 1 : 9
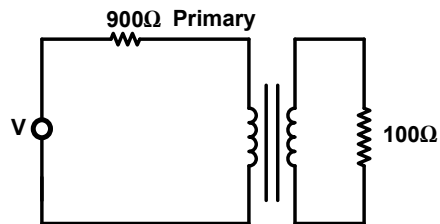
Q.24: A lamp of 100W at 200V is supplied current at 100 volts. It will be equivalent to the lamp of:

    a. 50W

    b. 40W

    c. 25W

    d. 10W

Q.25: The CPU structure contains:

    a. Cache, ALU, Control Unit and Control Memory

    b. System Bus, ALU, Control Unit and Registers

    c. Memory, ALU, Control Unit and Cache

    d. Registers, ALU, Internal CPU Interconnection and Control Unit

Q.26: Chock Speed of which Intel microprocessor is 3 GHz?

    a. Core 2 Duo

    b. Core 2 Quad

    c. Pentium 4

    d. Pentium III

Q.27: Normally, the FPGA resources are used less than 70% because:

    a. Routing becomes excessively complicated

    b. Power issues

    c. Clock frequency

    d. Simulation time increases

Q.28 In which layer Telnet and FTP works?

    a. Application

    b. Session

    c. Network

    d. Physical

Q.29: As we know when there is a joint in optical fiber then there will be some loss then this loss be minimized by

    a. Using index matching fluid in the gap

    b. Making V-grooved splicing

    c. Both (a)and (b)

    d. Making carefully polishing

Q.30: Fast fading occurs if the channel_____ changes rapidly within the symbol duration.

    a. Bandwidth

    b. Frequency

c. Impulse response

d. None of the above

Answers:

1. c
2. c
3. a
4. c
5. c
6. a
7. b
8. a
9. c
10. a
11. b
12. a
13. a
14. a
15. b
16. b
17. c
18. a
19. c
20. a
21. c
22. c
23. a
24. c
25. d
26. b
27. a
28. a
29. a
30. c

Part-III (Depth: Mechatronics Engineering)

Total Marks/ MCQs: 40   **Total Time: 3 hours**

(Sample MCQs = 20)

Q.1: FET performs the same function as NPN BJTs, except that they are _____ in contrast to   BJT devices.

   a. Current controlled
   b. Voltage controlled
   c. Frequency controlled
   d. Resistance controlled

Q2. The A three phase half wave controlled rectifier is operated from a three phase y-connected 230V , and 50 Hz ,supply , the load resistance is 12 Ω. If the average output voltage is 30% of the maximum possible average voltages, the delay angle would be:

   a. 78.71150
   b. 88.71150
   c. 98.2330
   d. 100.230

Q3. If supply voltage = 5V, Forward current = 10mA and Vf(typ) = 1.8V, then R1 calculated in the given Figure is to be:

   a. R1 = (5/0.01) Ω
   b. R1 = (1.8/0.01) Ω
   c. R1 = (3.2/0.01) Ω
   d. R1 = (6.8/0.01) Ω
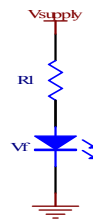
Q.4: The resonant frequency ω_r and the -3dB bandwidth can be related to the _____ of transient response.

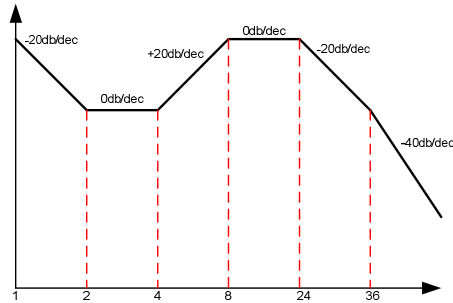   a. Speed
   b. Frequency
   c. Phase
   d. Amplitude

Q.5: Steady State Response is also called:

   a. Natural response

b. Transient response
c. Forced response
d. None of above

Q.6: The magnitude plot of a transfer function $G(s) = \dfrac{k(1+0.5s)(1+as)}{s(1+\dfrac{s}{8})(1+bs)(1+\dfrac{s}{36})}$ is shown in figure

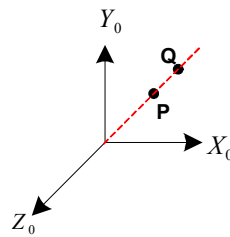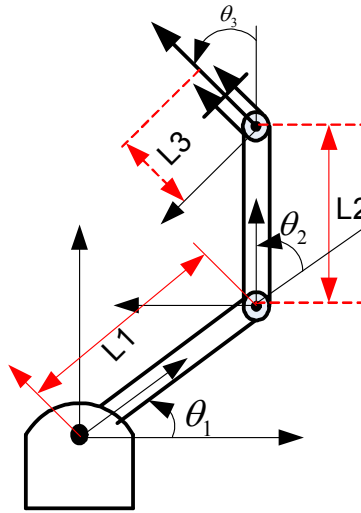below, where $k = 8$, the value for a and b will be:

a. ¼,1/24
b. ¼,1/36
c. ½,1/8
d. ½,1/10

Q.7: Conversion from projective coordinates $(x,y,z,k)^t$ to Cartesian coordinates $(x,y,z)^t$ is a transformation. Select the correct coordinates of point P shown in figure:

a. $x = X/k, y = Y/k, z = Z/k$

b. $x = Xk, y = Yk, z = Zk$

c. $x = k/X, y = k/Y, z = k/Z$

d. Non above

Q.8: Figure shows a three link planner arm, which is a RRR (or 3R) mechanism. Choose correct link parameters of the 3-link planner manipulator:

a

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	θ_1
2	0	L_1	0	θ_2
3	0	L_2	0	θ_3

b

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	θ_1
2	0	L_3	0	θ_2
3	0	L_1	0	θ_3

c

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	θ_1
2	0	L_2	0	θ_2
3	0	L_3	0	θ_3

d

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	θ_1
2	1	L_1	0	θ_2
3	0	L_3	0	θ_3

Q.9: Figure shows the simulated humanoid robot in a seated position, where the right arm and right leg can be treated as two independent manipulators. The right arm is treated as a simple open kinematic-chain with the upper body as its base link. The lengths of the upper link(link-1), lower link(link-2) and hand link (link-3) of the right arm are 20cm, 20cm and 8cm respectively. The origin of the base links frame (frame 0) is at $(0,80cm)$ in the world frame. If the input of the joint angles are $q_1 = 37.5°, q_2 = 98.5°$, $q_3 = -36.0°$ then find out the origin of the hand link's frame with respect to the world frame.
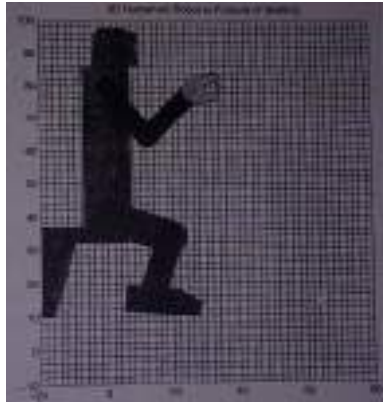
a. $x = 30cm, y = 80cm$ c. $x = 40cm, y = 90cm$

b. $x = 33.9469cm, y = 79.9089cm$ d. $x = 31.5cm, y = 80cm$

Q.10: If threshold T depends on the spatial coordinates x & y, then the threshold is called:

a. Global
b. Local
c. Dynamic
d. Global and Local.

Q.11: An operation produces an output image in which the intensity at a point depends upon the neighborhood of corresponding points in an output image is known as:

a. Local level
b. Global level
c. Object level
d. Point level

Q.12: Given a set of 3x3 neighborhood. When applying median filter what would be the median value of the 3x3 neighborhood:-
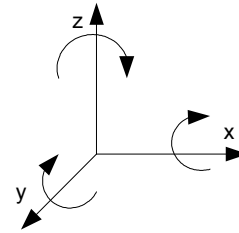
75	99	36
38	49	10
19	98	22

a. 99
b. 49
c. 98
d. 38

Q.13: A body that is free in space can move in three, independent, mutually perpendicular directions and rotate in three ways about those directions as shown in figure.
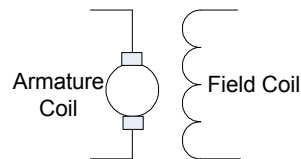
It is said to have that body have:

a. 3 degree of freedom
b. 6 degree of freedom
c. 9 degree of freedom
d. 12 degree of freedom

Q.14: Figure shows the DC motor with field coils. This arrangement is classified as:

a. Series wound motor
b. Shunt wound motor
c. Separately excited motor
d. Compound wound motor.

Q.15: Given in the figure is compound gear train with A, the first driver having 15 teeth, B 30 teeth, C 18 teeth and D, the final driven wheel, 36 teeth. Then the overall gear ratio and angular velocity of wheel D is:

a. 2,   20 rev/min
b. 4,   40 rev/min
c. 6,   60 rev/min
d. 8,   80 rev/min
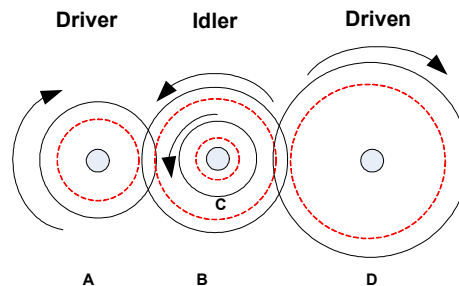
Q.16: Natural Frequency of Transverse Vibration of the beam (Neglecting the self weight of the beam) can be expressed as:

a. $\omega_n = \sqrt{mk}$

b. $\omega_n = \left(k/m\right)^{1/2}$

c. $\omega_n = \left(k/m\right)^{2}$

d. $\omega_n = k.m$

Q.17: A metal block, placed on a rough surface, is attached to a spring and is given an initial displacement of 10cm from its equilibrium position .After 5 cycles of oscillations in 2 sec,

the final position of the metal block is found to be 1 cm from its equilibrium position. Find the coefficient of friction between the surface and the metal block:

a. $\mu = 0.11$

b. $\mu = 0.22$

c. $\mu = 0.1132$

d. $\mu = 0.2232$

Q.18: The boom AB of the crane shown in figure (a) is a uniform steel bar of length 10m and the area of cross section $2.500\,mm^2$. A weight w is suspended while the crane is stationary. The cable CDEBF is made of steel and has a cross section area of $100\,mm^2$ .Neglecting the effect of the cable CDEB .find the equivalent spring constant of the system in vertical direction:
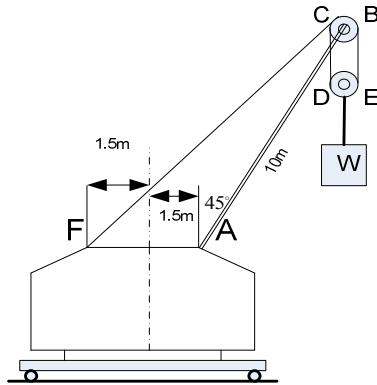
a. $k_{eq} = 25 \times 10^6 \, N / m$

b. $k_{eq} = 26.4304 \times 10^6 \, N / m$

c. $k_{eq} = 26 \times 10^4 \, N / m$

d. $k_{eq} = 25 \times 10^4 \, N / m$

Q.19: An optical encoder has 1024 slots on the disc. The resolution of such an encoder is:

a. 360/1024

b. 1024/360

c. 1024-360

d. 1/360

Q.20: If the stopper motor has a stop angle of 7.5^o what digital input rate is required to produce a rotation of 10 rev/sec:

a. 68

b. 860

c. 680

d. non above

Answers:

1. b
2. c
3. b
4. c
5. a
6. a
7. a
8. a
9. b
10. c
11. a
12. d
13. b
14. c
15. b
16. b
17. c
18. b
19. a
20. c