21417|EP|024

Total No. of Pages 2 *Roll No. .....*

FOURTH SEMESTER **B.Tech. [EP]**

END SEMESTER EXAMINATION *(Nov-2018)*

EP205 Classical & Quantum Physics

Time: 3:00 Hours ***Max. Marks :50***

Note: Answer ***ALL Questions.***

All questions carry equal Marks.Assume suitable missing data, if any.

Q 1 Attempt any two questions out of the following:

a). Explain Generalized Coordinates and obtain the expression for generalized velocity, Kinetic energy and momentum. (5)

b). Obtain Lagrange's equations of motion from D Alembert's principle. Find the Lagrangian for a LC circuit and also deduce the time period. (5)

c) Describe the term 'Constraints' with two examples. In the following cases, discuss whether the constraint is holonomic or non-holonomic. Give reasons for your answer.

i) A bead on a circular wire

ii) Motion of a body on an inclined plane under gravity (5)

Q 2 Attempt any two questions out of the following:

a). What is meant by Phase space? Derive Hamilton's canonical equations of motion in generalized coordinates and explain the significance of Hamiltonian. (5)

b). Obtain the Hamiltonian for an anharmonic oscillator, whose Lagrangian is given by $\mathbf{L}(x,\dot{x}) = \frac{1}{2}x^2 - \frac{1}{2}\omega^2 x^2 - ax^3$ (5)

c). Prove the statement, "A function whose Poisson bracket with Hamiltonian vanishes is a constant of motion". (5)

Q 3 Attempt any two questions out of the following:

a). Discuss the motion of a particle under a central attractive force inversely proportional to the square of the distance from the center of force. Find the conditions under which the orbit will be an ellipse, parabola or hyperbola. (5)

b) A particle of mass m moves in a central force field defined by $\mathbf{F} = \frac{-k\,r}{r^4}$. Showthat if E is the total energy supplied to the particle, then its speed is given by $v = \sqrt{\left(\frac{k}{mr^2} + \frac{2E}{m}\right)}$. (5)

c) A particle of mass *m*trapped in the potential $V(x) = 0$ for-$a \leq x \leq a$ and $V(x) = \infty$ otherwise. Evaluate the probability of finding the trapped particle between $x=0$ and $x=a/n$ when it is in the n^{th} state. (5)

Q 4 Attempt any two questions out of the following:

a). Prove that i) $[\hat{f}(r), \hat{p}_x] = i\frac{h}{2\pi}\frac{\partial \hat{f}(r)}{\partial x}$

ii) Find the value of commutator $[\hat{f}(r), \hat{p}_x^2]$. (5)

b). The unperturbed wave functions of a particle trapped in an infinite square well of bottom a are $\psi_n^0 = \left(\frac{2}{a}\right)^{1/2} \sin\frac{n\pi x}{a}$. If the system is perturbed by raising the floor of the well by a constant amount V_0, evaluate the first – and second – order corrections to the energy of the n^{th} state. (5)

c) Discuss briefly the validity conditions of WKB approximation. Apply the method to obtain the quantization condition for a bound state. (5)

Q 5 Attempt any two questions out of the following:

a). A particle of mass m is moving in a 1-D box defined by the potential V = 0, $0 \leq x \leq a$ and $V = \infty$ otherwise. Estimate the ground state energy using the variational trial function $\emptyset(x) = \sqrt{\frac{30}{a^5}}x\,(a-x)$. (5)

b). Express the operators for the angular momentum components L_x, L_y, L_z in the spherical polar coordinates. (5)

c). A particle of mass 'm' moves in a plane in the field of force given by (in polar coordinates)$F = -k\,r\cos\theta\hat{r}$, where k is constant and $\hat{r}$ is the radial unit vector.Will the angular momentum of the particle about the origin be conserved? Justify your statement. (5)

Total no of pages 03 *Roll no... .. ..*

THIRD SEMESTER **B.Tech. [EP]**
MID SEMESTER EXAMINATION **NOV-2018**

ME 251-ENGINEERING MECHANICS

Time: 3 :00 Hours **Max Marks: 50**

Note: Answer FIVE Questions. Question No 1 compulsory. Assume suitable missing data, if any.

1 **Answer all the fallowing equations**

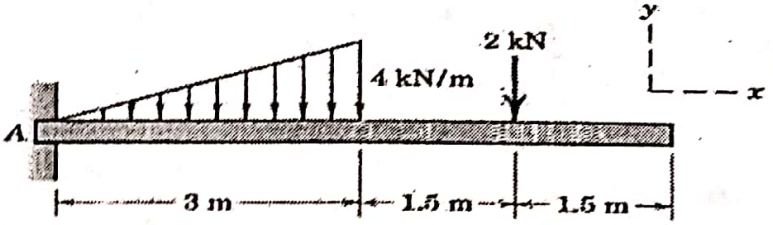
a. State and prove Varignon's theorem [2.5]

b. Enumerate the different types of supports and their reactions? [2.5]

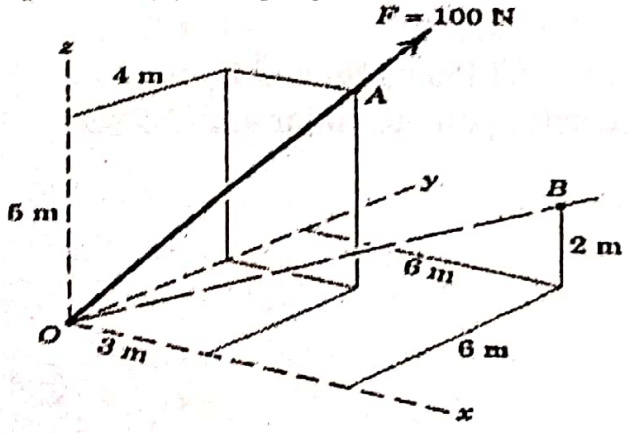
c. State the Parallel–axes theorem. Write the formulae for determining moment of inertia of a rectangular section of width b and depth d about the centroidal axes. [2.5]

d. The speed of the flywheel changes from 10 rad/sec to 30 rad/sec in 5 seconds. Determine the angular acceleration of the flywheel .How many revolutions the wheel would turn to attain a speed of 600 rev/min? [2.5]

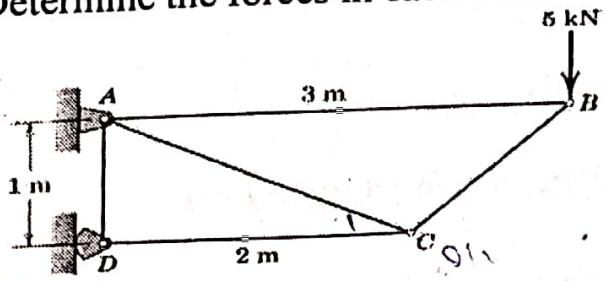
2 a. Determine the reactions at A for the cantilever beam. [5]



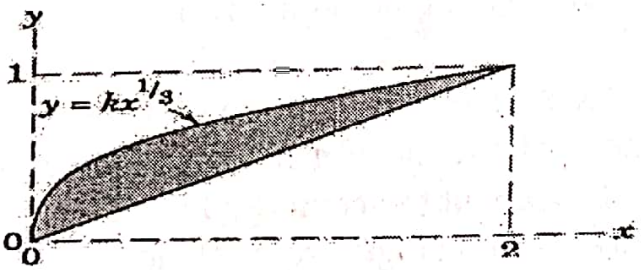
b. A force F with a magnitude of 100 N applied at the origin O of the axis x-y-z as shown. The line of action of F passes through point A. Determine (a) x, y, z scalar component of F (b) Projection F_{XY} of F on the x-y plane (c) the projection F_{ob} of F along the line OB [5]



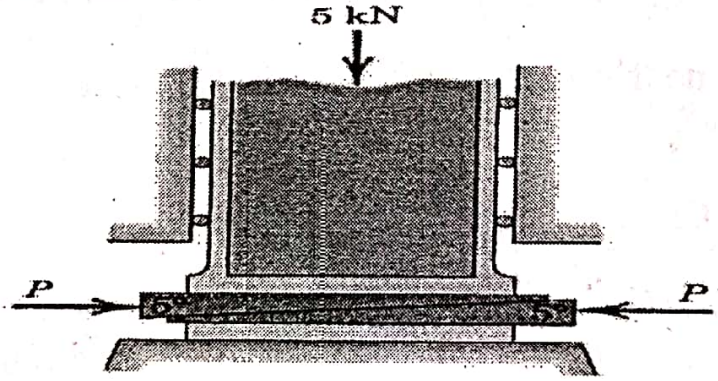
3 a. Determine the forces in each member of the truss [5]



b. Determine the x and y co-ordinates of the centroid of the shaded area. [5]

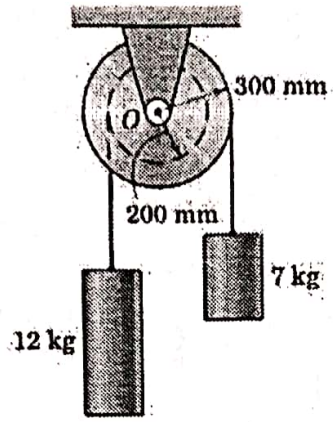


4 a. Determine the forces p required to raise the column if coefficient of friction of all faces is 0.4. [5]

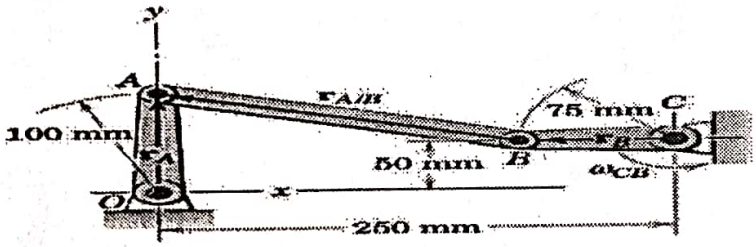


b. A straight bar hinged at one end rotates in a horizontal plane its position at any time t is defined by the angle $\Theta = 2\,\Pi\,(t - 1.5\,t^2)$ radians with the x-axis .A collar sliding on this bar has a mass of 5 kg and its position on the bar at time t is defined by the distance $r = (2t^2 - 0.9t^3)$ meters from the hinge. Find the radial and transverse components of force acting on the collar at t=2.5 sec [5]

5 a. The Frictional moment at the pivot is 2 N-m .Determine the angular acceleration of the grooved drum which has a mass of 8 Kg and raius of gyration Ko =225mm. [5]



b. Crank CB oscillates about c through a limited arc , causing crank OA to oscillate about O.When the linkage passes the position shown with CB horizontal and OA vertical , the angular velocity of CB is 2 rad/sec Counterclockwise. For this instant Determine angular velocities of OA & AB. [5]



Write short note on any of two [10]

a Principle of Virtual work

b Guldinus theorem and its applications

c Chasle's theorem

END

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THIRD SEMESTER **B.Tech. (EP)**

END SEMESTER EXAMINATION *Nov/Dec-2018*

EP207: Digital Electronics (Engineering Analysis and Design)

Time: 3:00 Hours *Max. Marks : 40*

Note : Attempt 8 questions in all. All questions carry equal marks. Assume suitable missing data, if any.

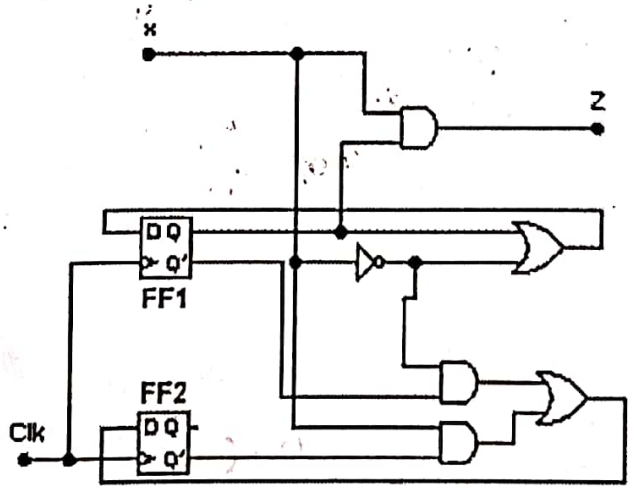
Q.1. How many bits are required at the input of a DAC if it is necessary to resolve the voltages to 30mV ? For a 8-bit DAC, determine the weights assigned to 3rd and 4th LSB; output voltage for 10010101 and the output change due to 1 LSB? Assume the full scale output voltage to be 10 V. 5

Q.2. Give truth tables of D, T and JK Flip-Flops. Explain the significance of XS3 Codes. 5

Q.3. Design a memory expansion interconnection of 16 x 4 static RAMs to construct a 64 x 4 memory. Each RAM has an active low- chip select line and common data-in pins. 5

Q.4. Using Behavioural Modeling, write a VHDL code for the design of a 1 to 4 line Demultiplexer. 5

Q.5. For the circuit given below, write its state table, state equation and draw the state diagram. 5



Q.6. Describe the Diode Transistor Logic (DTL) Family, explaining its circuit and operation. 5

Q.7. A circuit receives a 4-bit 8421 BCD Code. Design a minimum circuit to detect the decimal no. 1,2,3,6,7,8. Implement it in NAND. 5

Q.8. Design a synchronous counter using D-flip flop with the following count sequence: 7, 6, 5, 4, 3 and repeat. 5

Q.9. With neat sketch, explain the operation of a 3-bit PISO and SISO Shift Registers. 5

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2K17/EP/029

Total No. of Pages: 1 *Roll No. .....*

THIRD SEMESTER **B.Tech. [EP]**

END SEMESTER EXAMINATION ***November-2018***

EP-203: MATHEMATICAL PHYSICS

Time: 3.00 Hours ***Max. Marks: 50***

Note : Answer any **FIVE** questions.
Assume suitable missing data, if any.

1.[a] Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$ taken round the rectangle bounded by the lines $x = \pm a$, $y=0$, $y=b$. **(6)**

[b] Use divergence Theorem to evaluate $\iint_s \vec{F}.\overrightarrow{ds}$ where $\vec{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\,\hat{k}$ and S is the surface bounding the region $x^2 + y^2 = 4$, $z = 0$ and $z = 3$. **(4)**

2.[a] Define symmetric and skew-symmetric tensors. Prove that a symmetric tensor of rank 2 has at most $\frac{N(N+1)}{2}$ different components in N-dimensional space V_N. **(6)**

[b] Show that the array A= $\begin{bmatrix} -xy & -y^2 \\ x^2 & xy \end{bmatrix}$ is a tensor **(4)**

3.[a] Find the first three terms of the Taylor's series expansion of $f(z) = \frac{1}{z^2+4}$ about $z = -i$. **(6)**

[b] Test the analyticity of the function w=$\sinh z$ and find its derivative **(4)**

4.[a] Apply calculus of residues to evaluate $\int_0^{2\pi} \frac{d\theta}{(5-3\cos\theta)^2}$ **(6)**

[b] Apply Range-Kutta method to find approximate value of y when $x=0.1$, given that $10\frac{dy}{dx} = x^2 + y^2, y(0) = 1$. **(4)**

5. Find D' Alembert's solution of the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2\frac{\partial^2 y}{\partial x^2}$ by assuming the initial condition as $y=f(x)$ and $\frac{\partial y}{\partial t} = 0$ at $t=0$. **(10)**

6. Define any ***four*** of the following: **(4×2.5 = 10)**

[a] Curl of a vector function and its physical meaning

[b] Piezo-electric and Converse piezo-electric effect

[c] Harmonic function with an example [d] Mean operator/Averaging operator

[e] Interpolation and extrapolation with examples

Total No. of Pages: 3 *Roll No. .....*

THIRD SEMESTER **B.Tech.[EP]**

END SEMESTER EXAMINATION ***(NOV.-2018)***

EP-201 INTRODUCTION TO COMPUTING (NEW SCHEME)

Time: 3 Hours ***Max. Marks: 40***

Note: Question No. 1. is compulsory. Attempt any four from rest. Use comment line in each program to write the script/function file name.

1. Following commands are written and saved in a Matlab script file. What will the output of this file in the command window? [8]

```
A = [11 15 22 25; 12 11 13 20; 60 70 80 90; 6 7 9 1];
B=rot90(A,3)
C=A.^2
fix([4.3 -5.5])
x=[ 2  5  6  8 ]; y=[ 0  5 9  5 ];
z= x ~=y
```

2. (a) Explain the following commodes with suitable examples [4]

i. char
ii. triu
iii. subplot
iv. contour

(b) For ideal diode, the voltage V_L across the load R_L is given by

$$V_L = \begin{cases} V_s & Vs > 0 \\ 0 & Vs \leq 0 \end{cases}$$

Suppose the supply voltage is $V_s(t) = 3e^{-t/3}\sin(\pi t)$ *volts*. Where t is in seconds. Write a Matlab program to plot the voltage V_L versus t for $0 \leq t \leq 10$ with proper figure formatting. [4]

3. (a) The temperature of coffee cooling in a porcelain mug at room temperature (68°F) was measured at various times. The data given below

Time t (sec)	Temperature T (°F)
0	145
620	130
2266	103
3482	90

The empirical model for coffee's temperature as a function of time is given by $T = 68 + b(10)^{mt}$. Do the curve fitting and find out the unknown coefficient b and m with proper message on screen. [4]

(b) It is known that the following Leibniz series converses to the value $\pi/4$ as $n \to \infty$. [4]

$$S(n) = \sum_{k=0}^{n} (-1)^k \frac{1}{2k+1}$$

Plot the difference between $\pi/4$ and the sum $S(n)$ versus n for $0 \leq n \leq 200$.

4. (a) The following equation describes the motion of a mass connected to a spring, with a viscous friction acting between the mass and the surface. Another force $u(t)$ also act on the mass

$$m\frac{d^2y}{dt^2} + c\frac{dy}{dt} + ky = u; \quad y(t=0) = 2, \left.\frac{dy}{dt}\right|_{t=0} = -3$$

Convert the given equation into simultaneous differential equations. Use Matlab inbuilt function to solve and plot the position and velocity of a mass with a spring and damping, having the parameter values m =2, c=3, and k =7 on the single figure with proper leveling. The applied force u = 35. [4]

(b) The (x, y) coordinates of a certain object as a function of time t are given by $x(t) = 5t - 10; y(t) = 25t^2 - 120t + 144$ for $0 \leq t \leq 4$. Write a program to determine the time at which the object is the closest to the origin at (0,0). Determine also the closest distance. **[4]**

5. (a) Write a Matlab code to integrate $\int_0^6 \frac{1}{1+x^2} dx$ with trapezoidal method (Do not use inbuilt function for this integration). The output should be properly displayed. **[4]**

(b) Write a Matlab program which executes the motion of small circle of radius (r) on the circumference of the circle of radius (R). **[4]**

6. (a) In quantum mechanics treatment of a particle of mass m in a square well potential with depth $-V_0$ and width a, the solution for the energy E are usually written as

Even states: $\tan a\alpha = \beta / \alpha$

Odd states: $\cot a\alpha = -\beta / \alpha$

Where $\alpha = \sqrt{2mE/\hbar^2}; \beta = \sqrt{2m(V_0 - E)/\hbar^2}; \hbar^2 = 7.61 m_e eV \overset{0}{A}^2$

For the case of $V_0 = 10$ eV, $a = 3 \overset{0}{A}$ and $m = 1\ m_e$

Write a function script which takes the value V_0, a, m_e and range of energy E within which solution is possible and return the solution E using *bisection method.* **[4]**

(b) Write a function Script to calculate the sum of series say S_n; x and power of x should be given as input in the function file. **[4]**

$$S_n = \cfrac{1}{x^n + \cfrac{1}{x^{n-1} + \cfrac{1}{x^{n-2} \ldots\ldots + \cfrac{1}{x^2 + \cfrac{1}{x^1}}}}}$$