

PURBANCHAL UNIVERSITY

2018

B.E. (Civil/Computer/E. & C./Electrical Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG102SH: Mathematics-II (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

16×5=80

1/ Find the equation of the plane through the intersection of the planes $2x + 3y + 10z = 8$, $2x - 3y + 7z = 2$ and perpendicular to the plane $3x - 2y - 4z = 5$.

2/ Find the equation of the straight through the point (1,2,3) and parallel to the line of intersection of the planes $x - 2y + z = 3$ and $4x + 4y - 5z = 2$.

Or

Find the equation of perpendicular from the point (2, 4, -1) to the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$. Also obtain the foot of the perpendicular.

3/ Find the shortest distance between the lines $\frac{x}{2} = \frac{y}{-3} = \frac{z}{1}$ and

$\frac{x-2}{3} = \frac{1-y}{5} = \frac{z+2}{2}$. Find also the equation of the shortest distance.

4. Obtain the equation of the sphere which passes through the circle $x^2 + y^2 = 4$, $z = 0$ and is cut by the plane $x + 2y + 2z = 0$ is a circle of radius 3.

Or

Contd

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✓ Find the equation of the cone with vertex at (α, β, γ) and base ✓

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, z = 0.$$

5. Define and find the equation of cycloid in parametric form.
- ✓ 6. Find the eccentricity, directrix and identify the conic section and hence sketch the graph of the polar equation $r = \frac{6 \sec \theta}{2 \sec \theta + 6}$.

Or

Find the area of the surface generated by the revolution of the curve $r = 2(1 + \cos \theta)$ about the polar axis.

7. If $\phi = x^3 + y^3 + z^3 - 3xyz$, Find $\text{div}(\text{grad } \phi)$ and $\text{cur}(\text{grad } \phi)$.
8. If $\vec{r} = 2t^2\vec{i} + t\vec{j} - 3t^3\vec{k}$, evaluate $\int_1^2 \left(\vec{r} \times \frac{d^2\vec{r}}{dt^2} \right) dt$.
9. If \vec{a} and \vec{b} are constants, and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, prove that $\text{curl}[\vec{r} \times (\vec{a} \times \vec{b})] = 2\vec{b} \times \vec{a}$.

Or

Find the value of n so that vector $r^n \vec{r}$ is solenoidal.

10. Applying integral test to test the convergence of series

$$\sum_{n=1}^{\infty} \frac{1}{n^2 + n}$$

Or

Discuss the convergence of series. $\sum (\sqrt[3]{n^3 - 1} - n)$.

11. Determine the interval, radius and centre of convergence of the

power series: $\sum_{n=1}^{\infty} \frac{2^n (x-3)^n}{n+3}$

(3)

12. Solve: $\frac{dy}{dx} + \frac{2x-y+1}{2y-x-1} = 0$.

13. Solve: $xy - ydx = x\sqrt{(x^2 - y^2)}dx$.

14. Solve: $(D^2 + 4)y = x^2 \sin x$. ✓

Or

Solve: $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 2y = x \log x$

15. Solve the initial value problem:

$\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 5y = 0$ where $y = 0, \frac{dy}{dx} = -3$ when $x = 0$.

(16) Use the power series method to solve $y'' + xy = 0$. ✓

Or

Prove that: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \left(\frac{\sin x}{x} - \cos x \right)$.

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PURBANCHAL UNIVERSITY

2017

B.E. (Civil/Computer/E. & C./Electrical Second Semester/Final)

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG102SH: Mathematics-II (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

16×5=80

1. Find the equation of the plane which passes through the line of intersection of the planes $x + 5y - 2z = 6$ and $5x - 4y + 5z = 2$ and parallel to the line joining the points $(5, 1, 4)$ and $(-4, 2, 3)$.

Or

Find the locus of the point which moves such that the sum of the square of the distance of a point from the three planes $x+y+z=0$, $x+2y=0$ and $x-y+2z=0$ is 5.

2. Reduce the equation of line $x+2y+3z-6 = 3x+4y+5z-2$ in symmetrical form.
3. Find the shortest distance between the lines $\frac{x-3}{2} = \frac{y-4}{3} = \frac{z-5}{4}$ and $\frac{x-4}{3} = \frac{y-5}{4} = \frac{z-6}{5}$. Also find the equation of the shortest distance.
4. Obtain the equation of the sphere which passes through the circle $x^2+y^2=4$, $z=0$ and is cut by the plane $x+2y+2z=0$ is a circle of radius 3.

Or

Find the equation of the cone with vertex at (α, β, γ) and base

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1, z = 0.$$

Contd. ...

(2)

5. Prove that the surface area of sphere of radius r is $4\pi r^2$

Or

Prove that $r = \frac{ed}{1 + e \cos \theta}$, where the symbols have their usual meanings.

6. Find the area of the surface generated by revolving the curve $x = 2at, y = at^2, (0 \leq t \leq a)$ about y-axis.
7. Define an infinite series. Prove that the convergence of infinite series implies $\lim_{n \rightarrow \infty} u_n = 0$.

Or

Test the convergence of the series $\frac{x}{1.2} + \frac{x^2}{2.3} + \frac{x^3}{3.4} + \frac{x^4}{4.5} + \dots, x > 0$.

8. Determine the interval, radius and centre of convergence of the power series $\sum \frac{3^n x^n}{(n+1)^2}$.
9. Find n so that the vector $r^n \vec{r}$ is solenoidal.
10. Find the directional derivative of $\phi = \frac{x}{x^2 + y^2}$ along a line making an angle 30° with the positive x-axis at $(0,2)$.

Or

Prove that: $\text{div}(\vec{u} \times \vec{v}) = (\text{curl} \vec{v}) \cdot \vec{u}$

11. If $\phi = x^3 + y^3 + z^3 - 3xyz$, find $\text{div}(\text{grad } \phi)$ and $\text{curl}(\text{grad } \phi)$

12. Solve the following differential equation:
 $(2x + y + 1)dx + (4x + 2y - 1)dy = 0$.

13. Solve $(1 + v^2) \frac{dx}{x} + x = e \tan^{-1} y$.

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14. Solve: $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = xe^x \sin x$.

Or

Solve: $x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + 6y = x$

15. Solve the initial value problem:

$y'' - 2y' + (\pi^2 + 1)y = 0$ given that $y(0) = 1, y'(0) = 1 - \pi$.

16. Solve the power series method $\frac{d^2 y}{dx^2} + x^2 y = 0$.

Or

Prove that: $xJ'_n(x) = -nJ_n(x) + xJ_{n-1}(x)$.

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PURBANCHAL UNIVERSITY

2016

B.E. (Civil/Computer/E. & C./Electrical Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG102SH: Mathematics-II (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

16×5=80

1. The plane $x + 3y + 5z - 7 = 0$ is rotated about its line of intersection with the plane $x - 2y - 6z - 8 = 0$ through a right angle. Find the equation of the plane in its new position.
2. Find the distance of the point $(3, -4, 5)$ from the plane $2x + 5y - 6z = 16$ measured along a line with direction cosines proportional to $(2, 1, -2)$.

Or

Show that the lines $\frac{x}{1} = \frac{y-2}{2} = \frac{z+3}{3}$ and $\frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{4}$

are coplanar. Also find the equation of plane in which these line lie.

3. Find the magnitude and the equation of the shortest distance between the skew-lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $2x - 3y + 27 = 0$
 $= 2y - z + 20$.

4. Find the equation of the sphere which passes through the points $(0, -2, -4)$ and $(2, -1, -1)$, and whose centre lies on the line $5y + 2z = 0 = 2x - 3y$.

Or

Contd. ...

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Find the equation of the cone with vertex at (α, β, γ) and base $y^2 = 4ax; z = 0$.

5. Find the polar equation of a conic section with its focus at the pole.

Or

Find the area of the surface generated by revolving the curve

$$x = a(t - \sin t), \quad y = a(1 - \cos t); \quad 0 \leq t \leq 2\pi \text{ about } x\text{-axis.}$$

6. Find the area of the region bounded by the closed curve $r = 1 - \cos \theta$.

7. Test the convergence of the series $\sum_{n=1}^{\infty} \frac{n}{1+n\sqrt{n+1}}$.

Or

Show that the hyper-harmonic series $\sum \frac{1}{n^p}$ Converges if $p > 1$ and diverges if $p \leq 1$.

8. Find the interval, radius and centre of convergence of the power

$$\text{series } x - \frac{x^2}{\sqrt{2}} + \frac{x^3}{\sqrt{3}} - \frac{x^4}{\sqrt{4}} + \dots$$

9. The position vector of a moving particle at any time t is given by $\vec{r} = a(t - \sin t)\vec{i} + a(1 - \cos t)\vec{j}$. Find the velocity and acceleration of the particle at $t = \pi/4$.

10. Find the constants a, b, c so that the vector

$$\vec{v} = (x+2y+az)\vec{i} + (bx-3y-z)\vec{j} + (4x+cy+2z)\vec{k} \text{ is irrotational.}$$

(3)

11. Using gradient of scalar functions find the angle between the surfaces $x^2+y^2+z^2=9$ and $x^2+y^2-z^2=1$ at the point $(2, -1, 2)$

Or

If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, and \vec{a}, \vec{b} are constant vectors, show $\text{curl}[\vec{r} \times (\vec{a} \times \vec{b})] = 2\vec{b} \times \vec{a}$.

12. Solve the differential equation: $x \frac{dy}{dx} = y + \tan\left(\frac{y}{x}\right)$.

13. Solve the differential equation: $\frac{dy}{dx} + \frac{y}{x} = xy^2$.

Or

Define exact differential equation, solve

$$xdy - ydx = x\sqrt{x^2 - y^2} dx.$$

14. Solve the differential equation: $(D^2 - 4D + 3)y = e^x \cos 2x$.

Or

Solve the differential equation: $(x^2 D^2 - 2xD - 4)y = x^4$.

15. Solve the initial value problem:

$$y'' + 4y' + 5y = 0, \quad y(0) = 0, \quad y'(0) = -3.$$

16. Use the power series method to solve: $(1-x)y' - y = 0$.

Or

Prove that: $J_3(x)dx + J_2(x) + \frac{2}{x}J_1(x) = 0$, where the notation have their usual meanings.

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PURBANCHAL UNIVERSITY

2015

B.E. (Civil/Computer/E. & C./Electrical)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG1028H: Mathematics-II (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

1. Find the equation of the plane through the points $(-1, 1, -1)$ and $(6, 2, 1)$ and perpendicular to the plane $2x + y + z = 5$.

2. Find the image of the point $(1, 3, 4)$ in the plane $2x + y + z + 3 = 0$.

Or,

Find the distance of the point $(1, -2, 5)$ from the plane

$x - 3y + 5z - 3 = 0$ measured parallel to $\frac{x}{3} = \frac{y}{-2} = \frac{z+3}{4}$.

3. Find the length of the shortest distance line between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$, $2x - 3y + 27 = 0 = 2y - z + 20$.

4. Find the equation of the sphere having the circle $x^2 + y^2 + z^2 = 9$, $x - 2y + 2z = 5$ as the great circle.

Or,

Find the equation of the cylinder whose generators are parallel to

the line $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and passing through the curve $x^2 + 2y^2 = 1$, $z = 0$.

5. Find the surface area generated by revolving the curve $x = 3t^2$, $y = 2t^3$; $(0 \leq t \leq 1)$ about y-axis.

Contd. ...

(2)

Or

Find the length of the curve $r = \cos^2 \frac{\theta}{2}$.

6. Identify and sketch the polar curve $r = \frac{12}{6 + 2\sin\theta}$. Also find its eccentricity and directrix.

7. Test the following series for convergence $\frac{x}{1.2} + \frac{x^2}{2.3} + \frac{x^3}{3.4} + \dots$

Or

Apply integral test to test the convergence of the series

$$\sum_{n=1}^{\infty} \frac{1}{(3-2n)^2}$$

8. Find the interval, radius and centre of convergence of the series

$$\sum_{n=1}^{\infty} \frac{1}{(3+2n)^2}$$

9. If $\vec{r} = e^{ct} \vec{a} + e^{-ct} \vec{b}$ where \vec{a}, \vec{b} are constant vectors and c is a constant, show that $\frac{d^2 \vec{r}}{dt^2} - c^2 \vec{r} = \vec{0}$.

10. Prove that: $\text{div}(\vec{u} \times \vec{v}) = \vec{v} \cdot (\text{Curl} \vec{u}) - \vec{u} \cdot (\text{Curl} \vec{v})$ where, \vec{u} & \vec{v} are vector point functions.

11. Find the directional derivative of the function $\phi = x^2 - y^2 + 2z^2$ at the point $P(1, 2, 3)$ in the direction of the line \overline{PQ} where the point Q is $(5, 0, 4)$.

Or

Find the gradient of the scalar function $\psi = \log(\sin^{-1} r)$ where

$$\vec{r} = x\vec{i} + y\vec{j} + z\vec{k} \text{ and } |\vec{r}| = r.$$

Contd

(3)

12. Solve: $\frac{dy}{dx} = \frac{3xy + y^2}{3x^2}$

Or

$$(x+y+1)^2 \frac{dy}{dx} = 1$$

13. Solve: $(1+x^2) \frac{dy}{dx} + 2xy = \frac{1}{(1+x^2)^2}$

14. Solve: $(D^2 - 6D^2 + 11D)y = e^{-2x} + 3^{-3x}$.

Or

$$(D^2 + 3D + 2)y = e^{2x} \sin x.$$

15. Solve the following initial value problem:

$$y'' + 2y' + (x^2 + 1)y = 0 \text{ given that } y(0) = 1 \text{ and } y'(0) = 1 - \pi.$$

16. Solve the differential equation by power series method: $(x+1)y'$

Or

$$\text{Prove that: } xJ'_n(x) = nJ_n(x) - xJ_{n+1}(x).$$

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PURBANCHAL UNIVERSITY

2015

B.E. (Civil/Computer/E. & C./Electrical)/Second Semester/Final/Chance/Back
Time: 03:00 hrs. Full Marks: 80/Pass Marks: 32

BEG102SH: Mathematics-II

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

1. **Solve:** $\frac{dy}{dx} + \frac{y}{x^2} = \frac{1}{x^2}$

Or,

Solve: $x dy - (y + x^2 \log x) dx = 0$

2. **Solve:** $(1 + x^2) \frac{dy}{dx} + 2xy = 4x^2$

3. **Solve:** $\frac{d^2 y}{dx^2} + 5 \frac{dy}{dx} + 6y = 0$

Or,

Solve: $(x^2 D^2 - 2xD + 2)y = 4x^3$

4. **Solve:** $(D^2 - 4D + 3)y = 10e^{-2x}$ given that $y=1$ & $Dy=3$ when $x=0$.

5. Solve the differential equation by power series method:

$$\frac{d^2 y}{dx^2} + 4 \frac{dy}{dx} = 0.$$

Or,

Prove the Bessel's functions: $J_{\frac{5}{2}}(x) = \sqrt{\frac{2}{\pi x}} \left\{ \frac{3-x^2}{x^2} \sin x - \frac{3}{x} \cos x \right\}$

Contd. ...

(2)

6. Find the equation of the plane which is perpendicular to plane $5x+3y+6z=0$ and which contains the line of intersection of the planes $x+2y+3z=0$ and $2x+y-z+5=0$.

7. Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the lines $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x-y+z=5$.

Or,

Show that the lines $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ & $\frac{x}{1} = \frac{y-7}{-3} = \frac{z+7}{2}$

are co-planer. Also, find the equation of the plane containing them.

8. Find the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ & $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$. Find also the equation of shortest distance.

9. Find the equation of the sphere having the circle $x^2 + y^2 + z^2 = 9$, $x - 2y + 2z = 5$, as a great circle. Determine its centre & radius.

10. Find the points on the curve $x = 4t^2$, $y = t^3 - 12t$, $t \in \mathbb{R}$ at which the tangent is horizontal & vertical. Also find the equation of tangent at $t=1$.

11. Find eccentricity, identify the conic & directrix & hence sketch the graph of following polar equation of conic section

$$r = \frac{10}{3 + 2\cos\theta}$$

Or,

Find the length of the curve $r = 2(1 - \cos\theta)$.

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12. Test for convergence of the series

$$3 + \frac{3}{4} + \frac{3}{4^2} + \dots + \frac{3}{4^{n-1}} + \dots$$

Or,

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{5} + \frac{1}{9} + \dots + \frac{1}{2^{n-1} + 1} + \dots$$

13. Find the interval & radius of convergence of the power series

$$\sum \frac{(x+2)^n}{3^n n}$$

14. Prove that $\frac{d}{dt} \left(\frac{-dr_2}{r_1} - \frac{dr_1}{dt} r_2 \right) = \frac{-d^2 r_2}{dt^2} - \frac{d^2 r_1}{dt^2} r_2$

15. If $\vec{F} = (x+y+1)\vec{i} + \vec{j} - (x+y)\vec{k}$, show that $\vec{F} \cdot \text{Curl } \vec{F} = 0$.

Or,

If \vec{a} is a constant vector, prove that $\nabla \cdot (\vec{a} \times \vec{r}) = 0$.

16. If \vec{r} be a position vector and \vec{a}, \vec{b} are constant vectors, prove that:

$$\text{div} \left[(\vec{r} \times \vec{a}) \times \vec{b} \right] = -2 \vec{b} \cdot \vec{a}$$

Contd. ...

PURBANCHAL UNIVERSITY

2014

B.E. (Civil/Computer/E. & C./Electrical)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG102SH: Mathematics-II

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

1. The plane $lx + my = 0$ is rotated about its line of intersection with the plane $z = 0$ through an angle α . Prove that the equation to the plane in its new position is $lx + my \pm \sqrt{l^2 + m^2} \tan \alpha = 0$.

2. Find the distance from the point $(3, 4, 5)$ to the point where the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ meets the plane $x + y + z = 2$.

Or,

Prove that the lines $\frac{x+1}{2} = \frac{y+1}{3} = \frac{z+1}{4}$ and $x+2y+3z-14 = 0 = 2x - 3y - 2z + 10$ are coplanar and that they meet at point $(1, 2, 3)$.

3. Find the shortest distance between the lines $\frac{x}{2} = \frac{y}{-3} = \frac{z}{1}$ and $\frac{x-2}{3} = \frac{1-y}{5} = \frac{z+2}{2}$. Find also the equations of shortest distance.

4. Obtain the equation of sphere which passes through three points $(1, 0, 0)$, $(0, 1, 0)$, $(0, 0, 1)$ and has its radius as small as possible.

Or,

Find the equation of the cone with vertex (α, β, γ) and the base $y^2 = 4ax, z = 0$.

Contd. ...

(2)

5. Find the eccentricity, directrix and identify the conic and sketch the graph of $r = \frac{12}{2 + 6\cos\theta}$.

Or,

Find the parametric equations for a cycloid.

6. Find the area of surface generated by revolving the curve $r = 2 + 2\cos\theta$ about polar axis.

7. Test the convergence of series:

$$1 + \frac{2}{5}x + \frac{6}{9}x^2 + \frac{14}{17}x^3 + \dots + \frac{2^n - 2}{2^n + 1}x^{n-1} + \dots (x > 0).$$

Or,

Show that p-series $\sum_{n=1}^{\infty} \frac{1}{n^p} = \frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} + \dots$ converges for $p > 1$ and diverges for $p \leq 1$.

8. Find the interval and radius of convergence of the power series

$$\sum_{n=1}^{\infty} \frac{2^n (x-3)^n}{n+3}$$

9. If $\vec{r} = \vec{a}\cos\omega t + \vec{b}\sin\omega t$. show that $\vec{r} \times \frac{d\vec{r}}{dt} = \omega(\vec{a} \times \vec{b})$ and

$$\frac{d^2\vec{r}}{dt^2} = -\omega^2\vec{r} \text{ where } \vec{a} \text{ and } \vec{b} \text{ are constant vectors and } \omega \text{ is a constant.}$$

10. Prove that:

$$\text{Curl}(\vec{a} \times \vec{b}) = (\vec{b} \cdot \nabla)\vec{a} - (\vec{a} \cdot \nabla)\vec{b} + \vec{a} \text{ div } \vec{b} - \vec{b} \text{ div } \vec{a}$$

Or,

Find the angle between the surface $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$.

Contd. ...

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11. If $\vec{r} = (x, y, z)$ and \vec{a}, \vec{b} are constant vectors, prove that $\nabla \cdot [(\vec{r} \times \vec{a}) \times \vec{b}] = -2\vec{a} \cdot \vec{b}$

12. Solve: $\frac{dy}{dx} + \frac{3xy + y^2}{x^2 + xy} = 0$

Or,

$$\text{Solve } (2x+3y-5)dy + (3x+2y-5)dx = 0.$$

13. Solve: $\frac{dy}{dx} - 2y \tan x = y^2 \tan^2 x$

14. Solve $x^2 dy + xy dx + 2\sqrt{1-x^2} y^2 dx = 0$

Or,

$$\frac{d^2 y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x.$$

15. Solve $\frac{d^2 y}{dx^2} - 4\frac{dy}{dx} + 5y = 0$ given that $y = 1$ and $\frac{dy}{dx} = 0$ when $x = 0$.

16. Solve the following differential equation by power series method $y'' + 4y = 0$

Or,

$$\text{Prove that: } J_{-5/2}(x) = \sqrt{\frac{2}{\pi x}} \left(\frac{3}{2} \sin x + \frac{3-x^2}{x^2} \cos x \right)$$

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PURBANCHAL UNIVERSITY

2013

B.E. (Civil/Computer/Electronics & Comm.)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG102SH: Mathematics-II

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

1. Find the equation of the plane through $(-1, 1, -1)$ and $(6, 2, 1)$ normal to the plane $2x + y + z = 5$.

2. Find the equation of the straight line through point $(1, 2, 3)$ and parallel to the line of intersection of the planes $x - 2y + z = 3$ and $4x + 4y - 5z = 2$.

Or,

Find the equation of a plane containing the line $\frac{x-1}{2} = \frac{-y-1}{1} = \frac{z-3}{4}$ and is perpendicular to the plane $x + 2y + z = 12$.

3. Find the magnitude and the equation of line of shortest distance between the lines $\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}$ and

$$\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$$

4. Obtain the equation of sphere having its centre on the line $5y + 2z = 0 = 2x - 3y$ and passing through the two points $(0, -2, -4)$ and $(2, -1, -1)$.

Or,

Find the equation of the cone with vertex (α, β, γ) and base

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, z = 0.$$

Contd. ...

(2)

5. Find eccentricity, identify the conic and also sketch the graph of

$$r = \frac{10}{3 - 2 \cos \theta}$$

Or,

Find the area of surface generated by revolving the curve $x = 3t^2$, $y = 2t^3$, $0 \leq t \leq 1$ about y-axis.

6. Find the area of the region that is bounded by the cardioid $r = 1 + \cos \theta$.
7. The necessary and sufficient condition for vector function of a scalar variable to have a constant direction is $\bar{a} \times \frac{d\bar{a}}{dt} = 0$.

Or,

If $\phi = x^3 + y^3 + z^3 - 3xyz$, find $\text{div}(\text{grad} \phi)$ and $\text{curl}(\text{grad} \phi)$

8. If $\phi = x + y + z$; $\Psi = x^2 + y^2 + z^2$ and $p = xy + yz + zx$, show that $[\text{grad} \phi \text{ grad} \Psi \text{ grad} p] = 0$.

9. If $\bar{r} = (x, y, z)$ and \bar{a}, \bar{b} are constant vectors, prove that:

$$\nabla \cdot [(\bar{r} \times \bar{a}) \times \bar{b}] = -2\bar{a} \cdot \bar{b}$$

10. Test for convergence of the series:

$$\frac{x}{1} + \frac{1}{2} \frac{x^2}{3} + \frac{1.3}{2.4} \frac{x^3}{5} + \frac{1.3.5}{2.4.6} \frac{x^4}{7} + \dots$$

$$x + \frac{3}{5}x^2 + \frac{8}{10}x^3 + \frac{15}{17}x^4 + \dots + \frac{n^2 - 1}{n^2 + 1}x^n + \dots$$

11. Find the interval and radius of convergence of the series

$$\frac{1}{1.2}(x-2) + \frac{1}{2.3}(x-2)^2 + \frac{1}{3.4}(x-2)^3 + \dots + \frac{1}{n(n+1)}(x-2)^n + \dots$$

Contd. ...

12. Solve: $(xy^2 + x)dx + (yx^2 + y)dy = 0$ (3)

13. Solve: $\frac{dy}{dx} + \frac{2x}{1+x^2}y = \frac{1}{(1+x^2)}$

Or,

Solve: $x \frac{dy}{dx} + y = x^3 y^6$

14. Solve the differential equation (any ONE):

(a) $(D^2 - 2D + 1)y = x^2 e^x$

(b) $(D^2 + 3D + 2)y = e^{2x} \sin x$

15. Solve the initial value problem:

$$\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 3y = 10e^{-2x}, y(0) = 1, y'(0) = 3$$

16. Solve the following differential equation by power series method.

$$y'' + xy = 0$$

Or,

Prove that: $xJ_n(x) = -nJ_n(x) + xJ_{n-1}(x)$

PURBANCHAL UNIVERSITY
2012

B.E. (Civil/Computer/Electronics & Comm.)/Second Semester/Chance
Time: 03:00 hrs. Full Marks: 80/Pass Marks: 32
BEG102SH: Mathematics-II (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks.

Answer ALL questions.

1. Find the equation of the plane through the point $(-1, 1, -1)$ and $(6, 2, 1)$ normal to the plane $2x + y + z = 5$.

2. Find the distance from of the point $(3, 4, 5)$ to the point where the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ meets the plane $x+y+z=2$.

Or

Find the image of the point $P(1, 3, 4)$ in the plane $2x - y + z + 3 = 0$.

3. Show that the lines $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and $x = \frac{y-7}{-3} = \frac{z+7}{2}$ are coplanar. Also, find the equation of the plane containing them.

4. Find the equation of a sphere of which the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0$, $x + y + z = 3$ is a great circle.

Or

Show that the equation to the cone whose vertex is (α, β, γ) and base $z^2 = 4ax, y = 0$ is $(\beta z - \gamma y)^2 = 4a(\beta - \gamma)(\beta x - \alpha y)$.

5. Find the area of surface generated by revolving the curve $r = 2 + 2\cos\theta$ about polar axis.

6. Derive the Parametric Equation of a cycloid.

Or

Find the eccentricity, identify the conic; find the directrix and sketch the graph $r = \frac{15}{1 + 2\sin\theta}$.

Contd. ...

(2)

7. Find the interval and radius of convergence of the series $\sum \frac{x^n}{\sqrt{n}}$.

Or

8. Test for convergence of the series $\frac{x}{1.2} + \frac{x^2}{3.4} + \frac{x^3}{5.6} + \dots$ where $x < 0$.

Or

Test the convergence of the series $\sum_{n=1}^{\infty} \frac{n}{1+n\sqrt{n+1}}$.

9. The necessary and sufficient condition for the vector function \vec{a} of a scalar variable t to have a constant direction is $\vec{a} \times \frac{d\vec{a}}{dt} = 0$.

10. Find the angle between the normal to the surface $xy = z^2$ at point $(1, 4, 2)$ and $(-3, -3, 3)$.

Or

11. If \vec{a} is a constant vector, prove that $\nabla \cdot \left(\frac{\vec{a} \times \vec{r}}{r^n} \right) = 0$.

12. If $\vec{r} = (x, y, z)$ and \vec{a}, \vec{b} are constant vectors, prove that $\text{grad}[\vec{r} \cdot \vec{a} \cdot \vec{b}] = \vec{a} \times \vec{b}$.

13. Solve: $(x^2 - y^2)dx + 2xy dy = 0$

14. Solve: $(1 + y^2) + (x - e^{\tan^{-1}y}) \frac{dy}{dx} = 0$

15. Solve: $x dy - y dx + a(x^2 + y^2) dx = 0$

Or

$\sin x dy - y \cos x dx + y^2 dx = 0$.

Contd. ...

(3)

15. Solve: $\frac{d^2 y}{dt^2} + \mu x = 0 (\mu > 0)$, given that $x = a$ and $\frac{dx}{dt} = 0$

$t = \frac{\pi}{2\sqrt{\mu}}$

16. Solve the power series method: $y'' - y = 0$.

Or

Prove that: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$.

PURBANCHAL UNIVERSITY

2018

B.E. (Civil)/Second Semester/*Final*

Time: 01:30 hrs.

Full Marks: 40 /Pass Marks: 16

BEG149ME: Fundamental of Thermodynamics & Heat (New Course)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

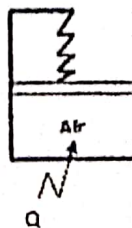
Answer ALL questions.

- 1(a) Differentiate between Microscopic viewpoint and Macroscopic viewpoint. 3
- (b) Derive an expression for work done transfer in adiabatic process. 3
- 2(a) Why Perpetual motion machine of the First Kind (PMM-1) is not possible? 3
- (b) A closed, rigid container of volume 0.5m³ is placed on a hot plate. Initially, the container holds two phase mixture of saturated liquid water and saturated water vapor at $P_1 = 1$ bar with a quality of 0.5. After heating, the pressure in the container is $P_2 = 1.5$ bar. Determine the temperature at each state and the mass of the vapor present at each state, in kg. Draw the T_v diagram. 4

Steam Table

P Kpa	T (C)	V _l m ³ /kg	V _g m ³ /kg	h _l KJ/kg	h _g KJ/kg
100	99.632	0.001043	1.6943	417.51	2675.1
150	111.38	0.001053	1.1595	467.18	2693.4

- 3(a) A piston cylinder device as in figure restrained by a linear spring contains 2kg of air initially at 150 kpa and 27°C. It is now heated until its volume doubles at which temperature reaches 527°C. Draw the process on P-V diagram and determine the total work and heat transfer in the process. [R= 287 J/Kg K and C_v 718J/Kg K]. 4



Contd. ...

(2)

(b) A reversible heat engine operates under two surroundings. In the first, it draws 12000KJ/s from a thermal source at 400°C and in the second one it draws 25000KJ/s from a thermal source at 100°C. In the both the operations, the engine rejects heat to a thermal sink at 20°C. Determine the operations, in which the engine delivers more power. 4

(c) State Kelvin-plank and Clausius statement of second law. 3

4(a) At the beginning of the compression process of an air standard Otto cycle, $P_1 = 100\text{kpa}$, $T_1 = 290\text{K}$, $V_1 = 400\text{cm}^3$. The maximum temperature in the cycle is 2200K and the compression ratio is 8. Determine: 6

(a) The heat addition, in KJ

(b) The net work, in KJ

(c) The thermal efficiency

(d) The mean effective pressure

[Take $R = 287 \text{ J/Kg K}$, $C_v = 716 \text{ J/Kg K}$]

(b) Define the various modes of heat transfer with suitable examples. 4

(c) An exterior wall of a house consists of 0.1m layer of common brick ($k=0.7\text{w/m}^\circ\text{C}$) followed by a 0.04m layer of gypsum plaster ($k=0.48\text{w/m}^\circ\text{C}$). What thickness of loosely packed rock wool insulation ($k=0.065\text{w/m}^\circ\text{C}$) should be added to reduce the heat loss or (gain) through the wall by 80 percent? 6



PURBANCHAL UNIVERSITY

2017

B.E. (Civil)/Second Semester/*Final*

Time: 01:30 hrs.

Full Marks: 40 /Pass Marks: 16

BEG149ME: Fundamental of Thermodynamics & Heat (*New Course*)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

- 1(a) How will you find out whether a given quantity is a thermodynamic property? How are those properties classified? Give examples.. 3
- (b) Derive the expression for the displacement work transfer for polytropic process. 2
- (c) Three pressure gauges are connected to a container consisting of two compartments as shown in Figure 1. If the local barometer reads 720mm of Hg and pressure gauges A and B read 300kPa and 120kPa respectively, determine the absolute pressure in each compartment and reading of pressure gauge C. [Take $\rho = 13600 \text{ kg/m}^3$ and $g = 9.81 \text{ m/s}^2$]. 4

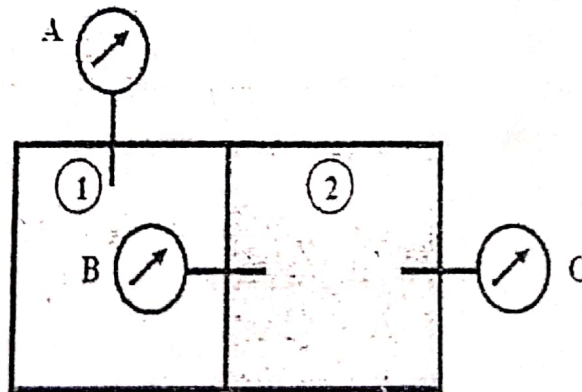


Figure 1

- 2(a) Define the following terms: saturation temperature, critical point and moisture content. 3

Contd. ...

(2)

(b) A closed, rigid container of volume 0.5m^3 is placed on a hot plate. Initially, the container holds two phase mixture of saturated liquid water and saturated water vapor at $P_1 = 100\text{kPa}$ with a quality of 0.5. After heating, the pressure in the container is $P_2 = 150\text{kPa}$. Indicate the initial and final states on p-v diagram, and determine:

- The temperature, in $^{\circ}\text{C}$, at each state
- The mass of the vapor present at each state, in kg.

(Refer to the attached table)

3(a) Derive the expression of first law of thermodynamics for control mass undergoing cyclic process. Define isentropic process. 3

(b) Air flows at a rate of 1.2 kg/s through a compressor, entering at 100kPa , 25°C , with a velocity of 60 m/s and leaving at 500kPa , 150°C , with a velocity of 120m/s . Heat lost by the compressor to the surrounding is estimated to be 20 kJ/kg . Calculate the power required to drive the compressor and diameters of inlet and exhaust pipes. [Take $R = 287\text{ J/kgK}$ and $C_p = 1005\text{ J/kgK}$] 5

4(a) Sketch the P-v and T-s diagrams for Rankine cycle. 2

(b) An air standard Diesel cycle has a compression ratio of 18, and the heat transferred to the working fluid per cycle is 1800 kJ/kg . At the beginning of the compression process, the pressure is 0.1 MPa and the temperature is 15°C . Determine. 6

- maximum pressure and temperature of the cycle.
- thermal efficiency, and
- mean effective pressure. (Take $R = 287\text{J/kgK}$, $c_p = 1005\text{ J/kgK}$ and $c_v = 718\text{ J/kgK}$)

4(a) Define thermal resistance. Write the expressions of thermal resistance for plane wall, hollow cylinder and convective heat transfer. 3

(b) A pipe ($k = 19\text{ W/mK}$) with inner and outer diameter of 2 cm and 4 cm respectively is covered with 3 cm layer of insulation ($k = 0.2\text{ W/mK}$). If the inside wall temperature of the pipe is maintained at 600°C and outside wall temperature of the insulation is maintained at 100°C , determine the heat loss per meter of length. Also determine the insulation interface temperature. 4

Table: Properties of SATURATED WATER - Pressure Table

P kPa	T $^{\circ}\text{C}$	v_f m^3/kg	v_g m^3/kg	v_g m^3/kg	u_f kJ/kg	u_g kJ/kg	u_g kJ/kg	h_f kJ/kg	h_g kJ/kg	h_g kJ/kg
100	99.632	0.001043	1.6933	1.6943	417.41	2088.3	2505.7	417.51	2257.6	2675.1
125	105.99	0.001048	1.3742	1.3752	444.25	2068.9	2513.2	444.38	2240.7	2685.1
150	111.38	0.001053	1.1584	1.1595	467.02	2052.4	2519.4	467.18	2226.2	2693.4

PURBANCHAL UNIVERSITY

2018

B.E. (Civil)/Second Semester/Final

Time: 01:30 hrs.

Full Marks: 40 / Pass Marks: 16

BEG149ME: Fundamental of Thermodynamics & Heat (New Course)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

1(a) Write differences of heat transfer and work transfer. 3

(b) Derive an expression for work transfer of a process under isothermal process. 3

(c) A one liter rigid closed vessel contains water at its critical conditions. This vessel is cooled until its pressure drops to 6 MPa. Calculate the mass of water in the vessel and the final dryness fraction. 4

2(a) What are heat engine, heat pump and refrigerator? Explain with schematic diagram. 4

(b) A gas undergoes a thermodynamic cycle consisting of three processes. 4

Process 1-2: compression with $PV = \text{constant}$, from $P_1 = 100$ kPa, $V_1 = 1.6 \text{ m}^3$ to $V_2 = 0.2 \text{ m}^3$, $U_2 - U_1 = 0$

Process 2-3: constant pressure to $V_3 = V_1$

Process 3-1: constant volume $U_1 - U_3 = -3549 \text{ kJ}$.

Sketch the cycle on P-V and T-V diagrams and determine the net work transfer and heat for process 2-3, in kJ.

3(a) An air-standard Diesel cycle has a compression ratio of 18, and the heat transferred to the working fluid per cycle is 1800 kJ/kg. At the beginning of the compression process the pressure is 0.1 MPa and the temperature is 15°C. Determine the thermal efficiency, work (in kJ/kg) and mean effective pressure of the cycle. Take $C_p = 1.005 \text{ kJ/kgK}$ and $R = 0.287 \text{ kJ/kgK}$? 6

Contd. ...

Mahdaj
Soni

(2)

- (b) Derive an expression of thermal resistance for a hollow cylinder. 4
- 4(a) Write an expression of first law of thermodynamics for control volume and reduce for adiabatic diffuser. 3
- (b) Draw and label working diagram of a vapor compression refrigeration cycle with components along with corresponding processes in P-h diagram. 3
- (c) A lake surface is covered by a 8 cm thick layer of ice [$k = 2.23$ W/m.K] when the ambient air temperature is -12.5°C . A thermocouple embedded on the upper surface of the layer indicates a temperature of -5°C . Assume steady state conduction in ice and no liquid sub cooling at the bottom surface of the ice layer find the heat transfer coefficient at the upper surface. Also work out the heat loss per unit area. 4

Properties of SATURATED WATER – Pressure Table

P	T	v_l	v_{lg}	v_g	u_l	u_{lg}	u_g
kPa	$^{\circ}\text{C}$	m^3/kg	m^3/kg	m^3/kg	kJ/kg	kJ/kg	kJ/kg
6000	275.62	0.001319	0.03112	0.03244	1205.4	1383.9	2589.3
7000	285.86	0.001352	0.02602	0.02737	1257.5	1322.7	2580.2
8000	295.04	0.001384	0.02214	0.02352	1305.5	1264.1	2569.6
22,000	373.77	0.002702	0.000952	0.003654	1953.4	142.80	2096.2
22,055	373.98	0.00311	-	0.00311	2017	-	2017



PURBANCHAL UNIVERSITY

2015

B.E. (Civil)/Second Semester/Final

Time: 01:30 hrs.

Full Marks: 40 /Pass Marks: 16

BEG149ME: Fundamental of Thermodynamics & Heat (New Course)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

1(a) What is thermodynamic system? Differentiate between open system, closed system and an isolated system. 1+3

(b) What do you mean by work transfer? Derive an expression to calculate work done during isothermal process. 4

(c) A gas undergoes a thermodynamic cycle consisting of three processes

Process 1-2: Compression with $pv = \text{constant}$ from $P_1=100\text{KPa}$, $V_1 = 1.6\text{m}^3$ to $v_2 = 0.2\text{m}^3$, $V_2 - V_1 = 0$

Process 2-3: Constant pressure to $V_3 = V_1$

Process 3-1: Constant volume $V_1 - V_3 = -3549\text{KJ}$.

Determine network and state whether it is power cycle or a refrigeration cycle. 5

2(a) Define saturation temperature, quality and critical point. 3

(b) Steam enters into well insulated throttling valve at 10MPa, 600°C and exits at 5MPa. Determine the final temperature of the steam (Prefer table). 4

At 10MPa;	600°C,	$h=3624.7 \text{ kJ/kg}$
At 5 MPa;	550°C,	$h = 3550.2 \text{ kJ/kg}$
At 5 MPa;	600°C,	$h = 3666.2 \text{ kJ/kg}$

3(a) Explain critical thickness of insulation. What is critical radius? 3

Contd. ...

(2)

- (b) A mild steel tank of wall thickness 12mm contains water at 95°C. The thermal conductivity of mild steel is 50 W/mC, and the heat transfer coefficients for the inside and outside the tank are 2850 and 10 W/m²C, respectively. If the atmospheric temperature is 15°C, calculate the rate of heat loss per m² of tank surface area and the temperature of outside surface of tank. 6
- 4(a) A heat pump has cop that is 45% of the theoretical maximum. It maintains a house at 20°C, which leaks energy of 0.8KW per degree temperature difference to the ambient. For a maximum of 1KW power input, find the minimum outside temperature for which heat pump is sufficient heat source. 5
- (b) An engine working on a diesel cycle has a compression ratio of 16 and the cut off takes place at 8% of the stroke. Determine its air standard efficiency. 6



PURBANCHAL UNIVERSITY

2014

B.E. (Civil)/Second Semester/Final

Time: 01:30 hrs.

Full Marks: 40 / Pass Marks: 16

BEG149ME: Fundamental of Thermodynamics & Heat (New Course)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

- 20
-16
4
1. Define a thermodynamic system. Derive an expression to calculate work done during an adiabatic process. 1+3
 2. Air enters a gas turbine system with a velocity of 105 m/s and has a specific volume of 0.8 m³/kg. The inlet area of the gas turbine system is 0.05 m². At exit the air has a velocity of 135 m/s and has a specific volume of 1.5 m³/kg. In its passage through the turbine system, the specific enthalpy of the air is reduced by 145 kJ/kg and the air also has a heat transfer loss of 27 kJ/kg. Determine, 4
(a) the mass flow rate of the air through the turbine system in kg/s
(b) the exit area of the turbine in m²
(c) the power developed by the turbine system in KW. 6
 3. What is perpetual motion machine of first kind (PMM 1)? Explain. 2 1
 4. A 10 kg metal piece with constant specific heat of 0.9 kJ/kg K at 200°C is dropped into an insulated tank, which contains 100 kg of water at 20°C. Determine the final equilibrium temperature and total change in entropy during the process. 6

Contd. ...

(2)

5. Define saturated vapor and quality. 2
6. Steam enters an engine at a pressure of 10 bar and 250°C. It is exhausted at 0.2 bar. The exhaust steam is 0.9 dry. Find the change in enthalpy and entropy. 3+3
7. The pressure, volume and temperature at the beginning of the compression of a constant volume cycle are 101 kN/m², 0.003 m³ and 18°C, respectively. The maximum pressure of the cycle is 4.5 MN/m². The compression ratio of the cycle is 9. The cycle is repeated 3000 times per minute. Determine for the cycle (i) the thermal efficiency (ii) the theoretical output in kilowatts. 6
8. Define "Critical thickness of insulation". 2
9. A mild steel tank of wall thickness 10 mm contains water at 90°C. Calculate the rate of heat loss per m² of the tank surface area when the atmospheric temperature is 15°C. The thermal conductivity of mild steel is 50 W/mK, and the heat transfer coefficients for inside and outside the tank are 2800 and 11 W/m²K, respectively. Calculate also the temperature of the outside surface of the tank. 6

≡

375 kW

$$Q = \frac{-kA(T_1 - T_2)}{\eta}$$

PURBANCHAL UNIVERSITY

2013

2

B.E. (Civil)/Second Semester/Final

Time: 01:30 hrs.

Full Marks: 40 /Pass Marks: 16

BEG149ME: Fundamental of Thermodynamics & Heat (New Course)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

1(a) Define state process & equilibrium. 1+1+1

(b) In a quasi equilibrium process in a closed system, a gas expand from volume of 0.15m^3 and a pressure of 120 kPa to a volume of 0.25m^3 in such a manner that $P(v + 0.03) = \text{constant}$, where v in m^3 . Calculate the work. 5

2(a) Explain two statements of second law of thermodynamics. 3

(b) A heat engine working on Carnot cycle converts one-fifth of the heat input into work. When the temperature of sink is reduced by 80°C , the efficiency gets doubled. Make calculations for the temperature of source and sink. 5

3(a) Define saturation point, critical point and triple point. 1+1+1

(b) A vessel of 0.05 m^3 capacities contains a mixture of saturated water and saturated steam at a temperature of 300°C . The mass of liquid present is 10kg . Find the mass of steam present in vessel, enthalpy & specific volume. (Refer steam table value) 5

T	P	v_f	v_g	h_f	h_g
300°C	8583.8 kPa	$0.001404\text{ (m}^3/\text{kg)}$	$0.02167\text{ (m}^3/\text{kg)}$	1344.1 (KJ/kg)	2748.7 (KJ/kg)

Contd. ...

PURBANCHAL UNIVERSITY

2012

3

45

B.E. (Electronics & Comm.)/Third Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG240ME: Thermodynamics, Heats & Mass Transfer

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

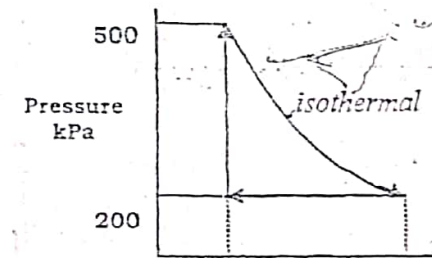
1(a) Define Thermodynamic system. 2

(b) What do you mean by PMM-I? Why is it impossible? 4

(c) From the adjoining P-V diagram, if initial temperature of gas is 27°C , Calculate: 5

(i) Net work of the cycle.

(ii) Determine whether the system is power or refrigeration system. 2



2(a) Draw and explain a neat and labeled T-V diagram for water. 4

(b) Steam enters an adiabatic turbine as saturated vapor at a pressure of 25 bars with velocity of 150 m/s . It exits at the pressure of 1.5 bar with the quality of 90% and velocity of 50 m/s . If the mass flow rate is 72 kg/s , what is the turbine output power? (Use steam table attached) 6

3(a) Define entropy. Show that the entropy of the universe is increasing. 4

(2)

(1) An ideal Otto Cycle with air as the working fluid has a compression ratio of 8. The minimum and maximum temperatures in the cycles are 300K and 1340K. 6+2

2

Determine:

- (i) The amount of heat transferred to the air during the heat addition process.
- (ii) The thermal efficiency.

4(a) What is a fin? 2

(b) Write the applications of heat transfer process in electronics and communication engineering?

3

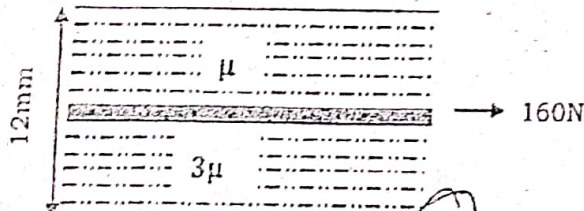
(c) A thick walled tube of stainless steel [$k = 19 \text{ W/m}^\circ\text{C}$] with 2cm inside diameter and 4cm outer diameter is covered with a 3 cm layer of asbestos insulation [$k = 0.2 \text{ W/m}^\circ\text{C}$]. If the inside wall temperature of the pipe is maintained at 600°C , calculate the heat loss per meter of length. Also calculate the tube- insulation interface temperature. Take the outside temperature of the insulation as 100°C . 7

4

5(a) Derive Bernoulli Energy Equation for an incompressible fluid. 4+2

(b) Define Boundary layer. 2

(c) The central plate of area 6 m^2 is being pulled with a force of 160 N between two oils with the dynamic viscosity in ratio 1:3. The viscosity of the top oil is 0.12 Ns/m^2 . Determine the velocity at which the central plate will move? 7



6(a) What are streamline and potential line? 2

(b) Differentiate between centrifugal pump and reciprocating pump. 4+2

4

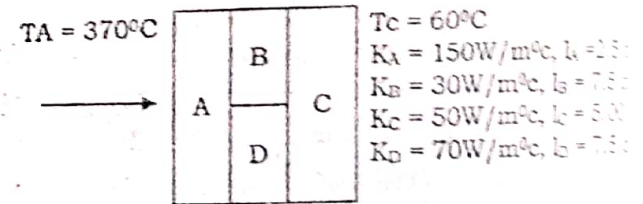
(2)

4(a) Describe the T-S diagram of Rankine cycle.

(b) The minimum pressure and temperature in an otto cycle are 100 kPa & 27°C . The amount of heat added to the air per cycle is 1500 KJ/Kg. Determine the pressure & temperature at points of the cycle. Also calculate the work, efficiency and effective pressure. 3 = 3/11

5(a) Define overall heat transfer coefficient.

(b) Find the heat flow through the composite wall as shown.



$A_A = A_C = 2A_B = 2A_D = 0.1 \text{ m}^2$

3

PURBANCHAL UNIVERSITY

2018

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG155CI: Building Construction (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

- 1(a) Explain the four sources of moisture in building. Also explain four way of moisture movement through building component with remedial measure with figure. 2+6
- (b) Compute the U value for a R.C.C roof slab 12 cm thick, insulated with 7 cm thick foam plastic finished with 3 cm thick tiles on the top and 1.5 cm thick cement plaster on the bottom. For roof $1/f_0=0.0515$ and $1/f_i=0.1710$. Also k_1, k_2, k_3, k_4 is 81.8, 136.4, 2.73, 69.7 (kcal cm/m² h deg C) respectively. 8
- 2(a) Explain the methods of improving bearing capacity of soil. Write about the types of shallow foundation with neat sketch. 3+5
- (b) Draw a figure showing basic element of pitched roof. Explain four types of single roofs with figure. 2+6
- 3(a) Define stair. Design a staircase for a private building for given space of 4.5×5.5m with floor height 3.6. Assume necessary data and draw a neat sketch to support the design. 2+6
- (b) What are the points to be considered while locating doors and windows? Explain in short the technical forms used to doors and window. 4+4
- 4(a) Why expansion joints are needed in building? Explain the treatment procedure for expansion joints in slab and wall with figure. 3+5
- (b) Explain four different method of formwork for excavation in trenches with figure. 8
- 5(a) What is load bearing and non-load bearing cladding? Describe the plastering procedure. 4+4

Contd. ...

(2)

- (b) What are the general principles of electrical services? Describe the safety precautions while managing electrical services. 8
- (a) Design a septic tank for a residential building with 5 numbers of users. Dimension the size in a neat plan. 5+3
- (b) What is ventilation and systems of ventilation? Explain four essential factors of ventilation. 2+2+4

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PURBANCHAL UNIVERSITY

2017

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG155CI: Building Construction (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

- 1(a) List out the major sources of moisture in Building. Explain the effect of moisture in building. 8
- (b) Find the transmittance of a composite wall that consist of 110mm brickwork as outer leaf, a cavity of 25mm, thermocole insulation of 25 mm, 110mm thick brickwork as inner leaf. There is 12mm thick plaster on external side of outer leaf and inner surface of inner leaf. The conductivities of the brickwork, cavity, thermocole insulation and plaster are 1.15, 0.026, 0.034 and 0.72 W/m°C respectively. The internal and external surface conductances are 8.12 and 10.0 W/m² °C. 8
- 2(a) Discuss about shoring and its types with neat sketches. 8
- (b) What are the requirements of roof? Explain lean-to-roof with necessary sketch. 8
- 3(a) Design a dog-legged staircase for a building in which the vertical distance between the floors is 3.6m. The stair hall measures 2.5m × 5m. Assume necessary data. Draw neat and clean sketch as per design. 8
- (b) Draw the neat sketches of door and window showing its parts. 8
- 4(a) What is scaffolding? Describe the types of scaffolding with neat sketches. 8
- (b) What are the types of joint? Explain expansion and construction joints with neat sketches. 8
- 5(a) Define cladding. Write its function. Sketches non-load bearing types of cladding. 8
- (b) What are the types and function of partition walls? 8

Contd. ...

(2)

6. Write short notes on any FOUR:

(a) Day Light Factor

(b) Lift and escalators ✓

(c) Safety precaution in wiring ✓

(d) Types of footing

(e) Septic Tank ✓

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PURBANCHAL UNIVERSITY

2018

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG155CI: Building Construction (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer EIGHT questions.

3×10=30

1. What are the various means of vertical movement in a building? Design a staircase for a residential building in a space of 5000 mm × 3500 mm, floor height of 3000mm. Justify your design output with plan and section of staircase. 7+3
2. What do you understand by temporary construction? List out the types of temporary construction and explain any two of them with necessary sketches. 10
3. What is moisture movement in a building? How the movement of moisture is controlled through the various types of wall sections. Explain with necessary sketches.. 3+7
4. Describe the construction details of a King-post truss with necessary figures. How king-post truss is different from queen-post truss? 5+5
5. Why the false ceiling is required in a building? What are the different types of false ceiling and describe the techniques of their installation. 2+3+5
6. Explain briefly about the types of window on the basis of their functional movement? 10

Q10

What are major functions of door? Draw and label a neat sketch of a paneled door.

Contd. ...

(2)

7. What are the characteristics and functions of foundation? Explain their types with suitable examples. Enlist the design parameters of a foundation. $4+4+2$
8. Why shoring is required? Describe the various types of shoring with necessary diagrams. $3+7$
9. Draw the schematic diagram showing the hot and cold water supply system in a residential building showing the various components required for its regulation. 10
10. Write short notes on any TWO: $2 \times 5 = 10$
- (a) Provision of Lifts and Escalators
 - (b) Joints in constructions and their treatment Procedure
 - (c) Safety and precaution in house wiring

PURBANCHAL UNIVERSITY

2015

B.E. (Civil)/Second Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG155CI: Building Construction (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

1(a) What do you mean by renewable and non-renewable sources of energy? What are the effects of moisture on building components? 4+4

(b) Design an dog legged staircase for a residential building in a room of 3.0m by 4.0m and ceiling height 3.2 m. Assume necessary data. Draw neat and clean sketch to support your design. 8

2(a) If an air gap of 50mm is provided between two half of the brick wall 150mm thick (each), calculate the overall thermal transmittance U for a given wall provided with 25mm thick cement plaster on both sides. Assume thermal resistance of 50mm air as 0.045. 8

Given:

Thermal conductivity for brick wall = 2.93 in KJ/m hr °C

Thermal conductivity for plaster = 2.09 in KJ/m hr °C.

Inside surface resistance = 0.041

Outside surface resistance = 0.012

(b) What are absorptive and reflective materials in acoustical design? Describe natural and artificial lighting. 4+4

3(a) Design a septic tank for a residential building with 6 numbers of users. Dimension the size in a neat plan. 8

Contd. ...

(2)

(b) What are the characteristics of good paint? Explain any two types of paints. 8

4(a) Where is the need of provision of joints? Briefly describe the types of joints. 3+5

(b) What is the functional use of windows in a building? Describe types of windows in detail. 2+6

5(a) What problems do you see in existing foundations nearby your vicinity? Describe underpinning of foundation by any method with neat sketch. 2+6

(b) What are the purposes of plastering of building? Briefly discuss about the types of plaster and defect in plastering. 8

6. Write short notes on any FOUR: 4×4=16

(a) Suspended ceilings

(b) Single timber roof and its types

(c) Damp Proof Course (DPC)

(d) Formwork in RCC beam and column with clean sketch.

(e) Partition walls: their types and functions

(f) Storage and distribution system of water supply

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PURBANCHAL UNIVERSITY

2014

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B. E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

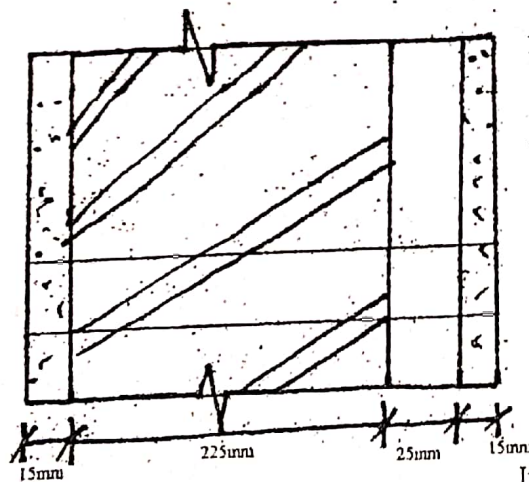
BEG155CI: Building Construction

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

- 1. Define water proofing in basement. Explain the methods for water proofing in basement. Explain the damp proof courses in building with neat sketches. 2+6+8
- 2(a) What is underpinning of foundation? Explain the methods of underpinning of foundation. 8
- (b) Explain single, double and triple roof with neat sketches. 8
- 3(a) What will be the U-value of the wall from the given figure if following informations are provided? 8



$$K_{\text{plaster}} = 81.8 \frac{\text{KCalcm}}{\text{m}^2 \text{h}^\circ \text{C}}$$

$$K_{\text{brick}} = 69.7 \frac{\text{KCalcm}}{\text{m}^2 \text{h}^\circ \text{C}}$$

$$K_{\text{foam}} = 2.73 \frac{\text{KCalcm}}{\text{m}^2 \text{h}^\circ \text{C}}$$

$$\text{Outer conductance} = 0.0515 \frac{\text{KCal}}{\text{m}^2 \text{h}^\circ \text{C}}$$

$$\text{Internal conductance} = 0.125 \frac{\text{KCal}}{\text{m}^2 \text{h}^\circ \text{C}}$$

- (b) Explain the types of windows with neat sketches. 8
- 4(a) What is scaffolding? Describe the types of scaffolding with a neat sketches. 8
- (b) What are the types and functions of a partition walls? Explain briefly. 8

Contd. ...

(2)

- 5(a) What are the needs for provision of joints? What are the characteristics of paint? 8
- (b) Explain the types of doors with a neat sketches and the functional requirement of a ventilation system. 8
6. Write short notes any FOUR: $4 \times 4 = 16$
- (a) Sound insulation
 - (b) Air conditioning
 - (c) Active and passive solar heating system
 - (d) Water distribution system
 - (e) Wiring system



PURBANCHAL UNIVERSITY

2013

B. E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks:-32

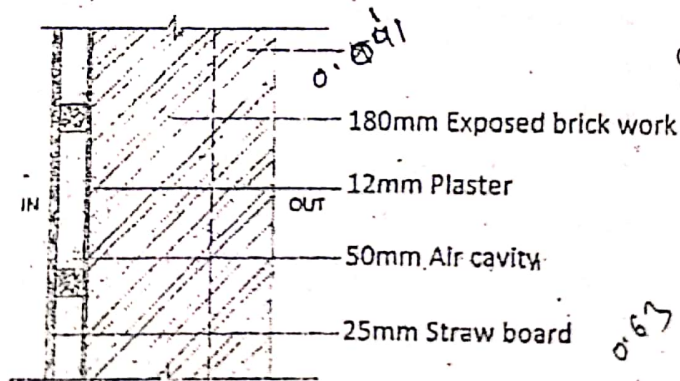
BEG155CI: Building Construction

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

- 1(a) List out the major sources of moisture in building. Explain general methods of water proofing in building. 6
- (b) Define Transmittance. Find the transmittance (U-Value) of wall that consists of 180 mm cuter exposed brick work, 12 mm thick plaster on internal surface of the wall, air cavity of 50 mm, and 25mm straw board. The conductivities of the brick work, plaster, air cavity, and straw board are $1.15 \text{ W/m}^\circ \text{C}$, $0.72 \text{ W/m}^\circ \text{C}$, $0.026 \text{ W/m}^\circ \text{C}$ and $0.093 \text{ W/m}^\circ \text{C}$ respectively. The internal and external surface conductance are 8.12 and $10.0 \text{ W/m}^2 \text{ }^\circ\text{C}$ 10



- 2(a) List the types of joint in a building. Explain expansion joint and construction joint with neat sketches. How are these joints treated? 8
- (b) Draw the neat figures of typical single and double timber pitched roof with necessary components and information. Explain in detail, the king post roof with figure. 8

Contd....

(2)

3(a) Explain the characteristics of a good staircase? Design a staircase for a residential building in a space of 4700 mm X 2200 mm, floor to ceiling height of 2900mm and slab thickness 100 mm. Assume the necessary data. Draw a neat sketch to support your design. 8

(b) Draw typical plan, elevation and section of door and window. Explain flush door and its type with necessary sketches. 3+5

4(a) What are the purpose of underpinning? Explain pit-method of underpinning and the precautions to be carried out during the underpinning. 2+4+2

(b) Discuss types of pile foundation and its uses in building construction. 5+3

5(a) What is pointing? Describe purpose and procedure of plastering. 3+5

(b) What is temporary construction? Describe raking shoring with neat sketches. (2+6)

6. Write short notes any FOUR:

4×4=16

(a) Partition wall

(b) Day light factor

(c) Airconditioning

(d) Trunking

(e) Water supply mains

(f) Lifts and escalators

PURBANCHAL UNIVERSITY

2012

B. E. (Civil)/Second Semester/Chance

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG155CI: Building Construction (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

1. Explain how the moisture moves through the building component and remedial measures to control it with a supporting sketches. 16
- 2(a) Define shoring. Explain different types of shoring provided during foundation strengthening with a neat sketches. 8
- (b) What are the requirements of a roof? Explain the types of single roof with a necessary sketches. 8
3. Design a dog-legged staircase for a residential building in a lobby of 4.5m × 3.0m and floor height 3.0m. Assume the necessary data. Draw a neat sketch to support your design. 16
- 4(a) What are the points to be considered while locating doors and windows? Explain in short the technical terms used to doors and windows. 4+4
- (b) Define joints. Explain the types of joints (construction and expansion joints) with a neat sketches. 8
- 5(a) What is framework? What are the requirements of a good framework. 8
- (b) What do you mean by cladding? What is the purpose of cladding? Sketch a non-loaded bearing type of cladding. 8
6. Write short notes on any FOUR: 4×4=16
- (a) Suspended ceiling
 - (b) Lifts and escalators
 - (c) Storage and distribution system of water supply
 - (d) Scaffolding
 - (e) Day-light factor

PURBANCHA, UNIVERSITY

2018

B.E. (Civil/B. Architecture)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG105SH: Communicative English (New Course)

Candidates are required to give their answers in their own words as far as practicable.

Answer ALL questions.

1. Read the following passage and answer the questions that follow it: 10

The aim is to create a new generation of rodents that can sniff out drugs or explosives, with the scientists saying the experiment is a proof of concept. In the future, rats, mice, and perhaps dogs, could be genetically altered to track down certain scents, they report in the scientific journal *Cell Reports*. "What we think we can do is make 'super sniffers for particular odours," said co-researcher Dr Paul Feinstein. "We trick the animals to want to pay attention to one odour over many others," added Dr Feinstein, an associate professor at Hunter College, City University of New York. The scientists used genetic modification to make mice better at detecting certain scents. The experiments were carried out with two known odours - a chemical that has a sweet smell similar to jasmine and another that smells like peppermint. The mutated mice could detect lower doses of these odours than non-mutated mice. The next step is to apply this research to detecting drugs or explosives. Rats are already being used in Africa to seek out landmines.

"We want to create an explosive-detecting rat or mouse - and we could also do this for narcotics such as cocaine, for example," said lead researcher Dr Charlotte D'Hulst of Hunter College. "If we can find the receptor that is activated by cocaine, we could create 'super-sniffing' cocaine rodents." The scientists see applications in the future in a number of areas: Military and defense - for example developing a rat that is better at sniffing out TNT, the main explosive component of landmines. Exploring human smell - mice can now be bred with human receptors for

Contd. ...

(2)

smelling particular odours, giving information about human olfaction. This could be useful in the fragrance and flavour industry, possibly to create new scents. Medical - some illnesses result in a loss of smell, as does ageing. The work could help in this area and possibly as a way to create some sort of "bio-reactor" made up of nerve cells to sniff out human diseases from the chemical signatures they give off in blood or sweat." We have these millions of years old receptors that are highly tuned to detect chemicals," Prof. Feinstein explained. "We think we can develop them into tools and use them to detect disease."

Questions:

- (a) What do you understand by "super-sniffers" and "bio-reactor" in the context of given passage?
 - (b) Can a new generation of a particular rodent detect a range of odours? What do the scientists say about this?
 - (c) Why were the experiments with two known odours carried out?
 - (d) Can rats be used in medical field too?
 - (e) Write a five-sentence summary of the given paragraphs.
- 3(a) Imagine that you have recently finished with a research study on Causes of Landslide in Hilly Region of Nepal. Prepare title page, Abstract, Table of contents and Findings of the Report. 10
- (b) What are the main causes of superstitions? Explain them with reference to the text. Keeping Errors at Bay. 10

Or,

Critically analyse the story 'who was to blame?' by Antonchekhov.

- a) Mark the primary stress in the following words: 4
Glorify, unilateral, facility, present (v), congress, engineering, terminate, abbard.
- i) Mark the tone in the following sentences:
(i) Where did you stay? (ii) Did he play or quit?

(3)

4. Use the verbs given in brackets in the correct tense:
- (a) Whenever she goes to shopping mall, she (spend) money.
 - (b) When she first (meet) her friend?
 - (c) I wish I (not leave) my village.
 - (d) No sooner she (reach) home than her father went away.

5. Change the following as indicated.

- (a) Why does he deride me? (into passive)
- (b) She said, "Do you like me?" (into indirect speech)
- (c) They said to me, "Why don't you see a doctor?" (into speech)
- (d) This could never be accomplished. (into active).

6. What is paragraph? Why do you need to change a paragraph writing? Describe the fundamentals of effective writing.

7. Imagine that you are the member secretary of a committee experts of the Reconstruction after Disaster in Nepal. Ten minutes of the meeting recently held to discuss and take the following agenda:

- 1.1 Minutes of the last meeting
- 1.2 Chairman's report
- 1.3 Appointment of an Office Assistant
- 1.4 Resignation of the Accountant
- 1.5 Date of the next meeting

8. Write an essay on any ONE:

- (a) Vulnerability of Nepal to Earthquakes
- (b) Role of media in National Policy

9. Write short note on any TWO:

- (a) Posture and Gesture in Effective Speaking
- (b) Format of Proposal Writing
- (c) Conduction of a Seminar

PURBANCHAL UNIVERSITY

2017

B.E. (Civil/B. Architecture)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG105SH: Communicative English (New Course)

Candidates are required to give their answers in their own words as far as practicable.

Answer ALL questions.

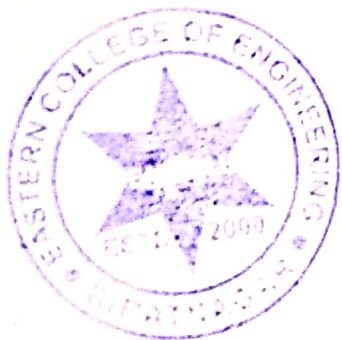
1. Read the following passage and answer the questions that follow it: 10

In recent years we have all been exposed to dire media reports concerning the impending demise of global coal and oil reserves, but the depletion of another key non-renewable resource continues without receiving much press at all. Helium - an inert, odourless, monatomic element known to lay people as the substance that makes balloons float and voices squeak when inhaled - could be gone from this planet within a generation.

The loss of helium on Earth would affect society greatly. Defying the perception of it as a novelty substance for parties and gimmicks, the element actually has many vital applications in society. Probably the most well known commercial usage is in airships and blimps (non-flammable helium replaced hydrogen as the lifting gas du jour after the Hindenburg catastrophe in 1932, during which an airship burst into flames and crashed to the ground killing some passengers and crew). But helium is also instrumental in deep-sea diving, where it is blended with nitrogen to mitigate the dangers of inhaling ordinary air under high pressure; as a cleaning agent for rocket engines; and, in its most prevalent use, as a coolant for superconducting magnets in hospital MIRI (magnetic resonance imaging) scanners.

The possibility of losing helium forever poses the threat of a real crisis because its unique qualities are extraordinarily difficult, if not impossible to duplicate (certainly, no biosynthetic ersatz product is close to approaching the point of feasibility for helium, even as similar developments continue apace for oil and coal). Helium is even cheerfully derided as a "loner" element since it does not adhere to other molecules like its cousin, hydrogen.

Contd. ...



(2)

According to Dr. Lee Sobotka, helium is the "most noble of gases, meaning it's very stable and non-reactive for the most part ... it has a closed electronic configuration, a very tightly bound atom. It is this coveting of its own electrons that prevents combination with other elements'. Another important attribute is helium's unique boiling point, which is lower than that for any other element. The worsening global shortage could render millions of dollars of high-value, life-saving equipment totally useless. The dwindling supplies have already resulted in the postponement of research and development projects in physics laboratories and manufacturing plants around the world. There is an enormous supply and demand imbalance partly brought about by the expansion of high-tech manufacturing in Asia.

A number of steps need to be taken in order to avert a costly predicament in the coming decades. Firstly, all existing supplies of helium ought to be conserved and released only by permit, with medical uses receiving precedence over other commercial or recreational demands. Secondly, conservation should be obligatory and enforced by a regulatory agency. At the moment some users, such as hospitals, tend to recycle diligently while others, such as NASA, squander massive amounts of helium. Lastly, research into alternatives to helium must begin in earnest.

Questions:

- (a) What kind of substance is Helium? Does it draw enough attention of the press? Describe.
- (b) What are the uses of Helium?
- (c) In what ways is Helium different from its cousin?
- (d) How can we avert the risk of losing Helium from the Earth?
- (e) Write a four sentence summary of the given paragraphs?

Write a letter of application for the post of a civil engineer in a private company based in Biratnagar. Also prepare resume to submit along with your application. 8

Describe the various causes of errors with reference to the text of Keeping Errors at Bay and the experiences in your society. 8

(3)

3. Mark the primary stress in the following words:
Conduct, excellent, moreover, blackboard, himself, gestation.
4. Transform the following as indicated:
 - (a) What can be said in this situation? (into Active Voice)
 - (b) Please, keep your errors at bay. (into Passive Voice)
 - (c) The government has to build shelters for the earthquake victims. (into Passive Voice)
 - (d) Rita said, "Where do you meet me, father?" (into Indi Speech)
 - (e) The woman said to her villagers, "Alas! I am ruined." (into ...)
5. Mark the intonation in the following sentences.
 - (a) He will play and I will dance.
 - (b) Why does she speak?
 - (c) I met Mr. Yadav, my old teacher.
 - (d) Please, work hard.
6. Assume that you are going to set up a manufacturing unit in your city. You wish for loan facility under the self employment scheme. Prepare a cover page, abstract and introduction part of the proposal for the manufacture of a food item, seeking loan from a finance company based in your city.
7. Write a thirty minute technical talk on Solution to Frequent Crisis in Nepal.
8. What are the fundamentals of effective writing? Describe any two of them in detail
9. Write short note on any TWO:
 - (a) Personal Appearance
 - (b) Minutes of a meeting
 - (c) Extensive Reading
10. Imagine that you are the coordinator of a committee formed to conduct a seminar on a new project on hydropower. Draft a notice along with a four point agenda to call the first meeting of all members of the committee.
11. Write a description of the landscape view of your own village you see from your own living room.

PURBANCHAL UNIVERSITY

2016

B.E. (Civil/B. Architecture)/Second Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG105SH: Communicative English (*New Course*)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

1. Read the following passage and answer the questions that follow it: 5×2=10

A clenched fist. Ask a doctor to explain how the heart works and nine times out of ten he will begin by telling you, "It's a muscle about the size of a clenched fist -----". It turns out, though that there is more to that fist than is apparent at first mention. It may be more harmful to your heart and your health than you can imagine.

A clenched fist reflects hostility. Hostility is a deep rooted and strong emotion. It's an amalgam of negative emotions like, frustration, cynicism, mistrust, anger and hatred. In a different sense hostility is not just a transient emotion, it is an emotional reservoir that rises and dips like the mercury in a barometer,

Hostile people are temperamental by nature. They are impatient and are easily moved to anger. They tend to speak in explosive bursts with clenched fist and teeth. They always seem to be in a hurry and they over react even over trifle matters. Someone coming up and spitting in your face would make just about anybody angry. But an elevator that does not arrive quite as fast as you might like would make only the hostile people angry. They are apt to imagine that the entire world is plotting against them. In a traffic jam, someone who is hostile doesn't think, "Look at all these people stuck out here," it's more like, "All these people are in my way".

Contd. ...

(2)

Research has shown that men with hostile personalities have almost five times as many heart attacks as those who show little anger. Just why hostility appears to predispose people to coronary disease is not known, but it has been found that angry emotions and stress can increase blood pressure and stimulate larger-than-normal increases in some hormones in the blood.

Questions:

- (a) What are the symptoms of hostility?
- (b) What is the impact of hostility on one's health?
- (c) How do hostile people perceive the world?
- (d) What effect does anger have on hormones?
- (e) Give a suitable title to the above passage.

2. Answer any two of the following questions: 2×10=20

(a) A large number of deaths are caused by road accidents. Why do so many road accidents occur? To answer this question, you want to do a study. Write a brief proposal to a motorist's organization sticking on title page, objectives, procedure and conclusion parts.

(b) Suppose that you are the secretary of a library committee and that the library needs some more books to be procured. Write a notice to call a meeting for it and write the minutes of the meeting.

(c) Write a job application for the post of Civil Engineer in Road Department of Govt. of Nepal. Also include your resume.

As a chief of English Instructions committee, write a memo to all the teachers of your committee informing them that they should conduct their internal assessment within a week. 5

Write short notes on any TWO. 2×5=10

- (a) Fundamentals of effective writing
- (b) Intensive Reading

(3)

5. Write an essay on any ONE.

(a) The Role of Women in Development.

(b) Hydropower Generation for the Economic Growth of Nepal.

6. Write a four level of the text of 'Marriage is a Private Affair' Chinua Achebe.

7. Supply the correct prepositions in the following blank spaces. 5×

- (a) I'll stand ^{at} you whatever happens.
- (b) He is seeing ^{at} the matter.
- (c) Our efforts resulted ^{at} success.
- (d) I can't make ^{at} what she wants.
- (e) He is living ^{at} his salary.

8. Change the following as indicated in brackets: 5×

- (a) They were made to stand outside (into Active Voice)
- (b) He gave me two rupees. (into Passive Voice)
- (c) We made him chairman of the committee yesterday. (into Passive Voice)
- (d) There is no time to loss. (into Passive Voice)
- (e) Books are going to be published today (into Active Voice)

9. Write the correct forms of the verbs given in brackets in following sentences: 5×

- (a) If he does that again, I (punish) him.
- (b) Tell me the answer and I (give) you a prize.
- (c) Were it to stop raining, I (go) for a walk.
- (d) If I (know) he was so busy, I should never have troubled him.
- (e) Hardly I (repair) one of her computers; when she brought another.

PURBANCHAL UNIVERSITY

2015

B.E. (Civil/B. Architecture)/Second Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG105SH: Communicative English (New Course)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer ALL questions.

1. Read the following passage and answer the questions that follow it: 4×2=8

The government of India's policy regarding the joint sector is derived from the Industrial policy Resolution, 1956 and the objective of reducing the concentrations of economic power. In appropriate cases the central and state governments have taken equity participation either directly or through their co-operation with private parties. Some joint sector units have come up in this way. This type of joint sector unit is a device which may be resorted to in specific cases having regard to the production targets of the plan. Each proposal for establishing a joint sector unit of this nature will have to be judged and decided on its merits in the light of the government's social and economic objectives. The joint sector will also be a promotional instrument, as for instance, in cases where state governments go into partnership with new and medium entrepreneurs in order to guide them in developing a priority industry.

The joint sector will not be permitted to be used for the entry of large houses, dominant undertakings and foreign companies in industries in which they are otherwise precluded on their own. In all the different kinds of joint sector units, the government will ensure for itself an effective role in guiding policies, management and operations, the actual pattern and mode decided as appropriate in each case.

Contd. ...

(2)

The government hopes that there will be greater certainty in the investment climate and all sections of the community will come forward to play their due role in the promotion of growth with self-reliance within the accepted framework of a socialist pattern of society.

Questions:

- (a) What is the objective of setting up industries in the joint sector?
- (b) How will the government exercise control over such units?
- (c) How will the government's policy lead to more certain and better investment climate?
- (d) What is the difference between joint sector units and public undertakings?
2. Answer any two of the following questions: $2 \times 8 = 16$
- (a) Describe the fundamentals of "Effective writing".
- (b) Imaging that you are the secretary in attendance at the tenth meeting of the management committee of Nepal Bazar held on July 15, 2009. Write the minutes of the meeting assuming the agenda to be as follows:
- (i) Minutes of the last meeting
- (ii) Chairman's report
- (iii) Appointment of delivery staff
- (iv) Any other matter with the permission of the chairman
- (c) Send a memo to all heads of department requesting them to attend the farewell ceremony organized by you as an executive director of road department in honor of one of the senior staff of the year, who is going to be retired shortly.
3. The older generations have to repent for their decisions against the opinion of younger generations. Justify with reference to the text 'Marriage is a Private Affair'. 10
4. Write a job application along with resume on the post of civil engineer in a reputed construction company. 8

(3)

5. Prepare a proposal to be submitted to your college for consumption of a library building. (Included the subheading introduction, problem, objective, methodology, budget and output).
6. Write an essay on the relevance of engineering study to development of the country.
7. Write short notes on any TWO of the following: $2 \times$
- (a) Format of the technical report
- (b) Seminar
- (c) Descriptive writing
8. Mark the stress on the given words: $8 \times 0.$
- civilization, power, walk, perfect, subject, beautiful, capacity, comfort (v).
9. Put suitable intonation mark in the following: $4 \times$
- (a) That is Sajju, a new student.
- (b) Will you study science or education?
- (c) I met Mr. Yadav, my old teacher.
- (d) Open your mouth.
10. Transform the following sentences as indicated: 4
- (a) Dr. Thapa launched a new plan. (into passive voice)
- (b) Let the order be given. (into active voice)
- (c) Ram said to me, "where do you live?" (into direct speech)
- (d) Roshan said, "I have lost my umbrella". (into indirect speech)

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PURBANCHAL UNIVERSITY

2015

B.E. (Civil/B. Architecture)/Second Semester/Final/Chance/Back

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG105SH: Communicative English

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer the following questions.

1. Read the following passage and answer the questions that follow it: 4×2=8

Elizabeth I was Queen of England for forty five years, from 1558 to 1603. During her reign many exciting things happened in England & overseas. Sometimes English people were in danger, as when Spain tried to conquer them.

Many famous Englishmen lived during the time Elizabeth was queen. There were heroes like Sir Francis Drake & Sir Walter Raleigh who went exploring in parts of the world that had not long been discovered. They returned to England with wonderful stories of happenings far away. They brought new plants from America, potatoes, tomatoes and tobacco; and also the first turkeys. English ships traded with India, Russia & remote countries where few foreigners had ever been.

Men who stayed at home also helped to make England a great country. It was once said that during Elizabeth's reign England became 'a nest of singing birds'. Men like W. Shakespeare, Christopher Marlowe, & Edmund Spenser wrote splendid plays & poetry that will last for ever & ever.

Questions:

- (a) For how long did Elizabeth I reign?
- (b) Why are Drake & Raleigh amongst the great names of history?
- (c) What is meant by "England became 'a nest of singing birds'"?
- (d) What were the countries to the east which England began to trade with?

Contd. ...

(2)

Answer any two of the following questions: $2 \times 8 = 16$

(a) Assume that you have decided to resign from the post of Assistant Civil Engineer in 'Purbanchal Construction Company', where you have been working for the last eight years. Write a resignation letter.

(b) Describe the fundamentals of "Effective speaking".

(c) Assume that you have recently made an excursion tour to a world heritage site-'Chitwan National Park'. Write a report for your colleagues.

Would you say that marriage in Nepal is a private affair? Express your views based on Chinua Achebe's story "Marriage is a private affair". 10

4. Imagine that you are the secretary of the 'Balaju Yatayat Sewa Company Ltd.', Balaju. Write a notice, giving the agenda of the fifth meeting. 8

5. What is seminar? Mention the parts of seminar paper and describe any one of them. $2+4+2$

6. Write an essay on one of the following: 10

(a) Technology & satisfaction (b) Role of Nepal in UN

7. Write short notes on any TWO: $4+4$

(a) Minutes preparation

(b) Extensive reading

(c) Unity and coherence

8. Mark the stress on the given words: $8 \times 0.5 = 4$

empower, talk, imperfect, subject, notify, capability, scientific, mark

9. Put suitable intonation mark in the following: $4 \times 1 = 4$

(a) I have cut my finger.

(b) Are you busy today? रुचि

(c) I live in Nepal, the country of Mt. Everest. रुचि, सुनिश्च

(d) Would you like to have tea or coffee? रुचि, रुचि

10. Choose the right verbs from the bracket by making them agree with their subjects. $4 \times 1 = 4$

(a) The colour of these shirts blue. (is/are)

(b) Curry & rice my favourite dish. (is/are/nothing)

(c) The teeth of this girl white. (is/are/nothing)

(d) The poet & the philosopher dead. (is/are)

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PURBANCHAL UNIVERSITY

2014

B. E. (Civil/B. Architecture) Second Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG105SH: Communicative English

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer the following questions.

1. Read the following passage and answer the questions that follow it: 10

Chinese people, from the dim mists of prehistory have been wall-conscious; from the Neolithic period - when ramparts of pounded earth were used - to the Communist Revolution, walls were an essential part of any village. Not only towns and villages; the houses and the temples within them were somehow walled, and the houses also had no windows overlooking the street, thus giving the feeling of wandering around a huge maze.

However, it is indeed a common mistake to perceive the Great Wall as a single architectural structure, and it would also be erroneous to assume that it was built during a single dynasty. The building of the wall spanned the various dynasties, and each of these dynasties somehow contributed to the refurbishing and the construction of a wall, whose foundations had been laid many centuries ago. It was during the fourth and third century B.C. that each warring state started building walls to protect their kingdoms, both against one-another and against the northern nomads.

The role that the Great Wall played in the growth of Chinese economy was an important one. Throughout the centuries many settlements were established along the new border. The garrison troops were instructed to reclaim wasteland and to plant crops

Contd. ...

(2)

on it, roads and canals were built, to mention just a few of the works carried out. All these undertakings greatly helped to increase the country's trade and cultural exchanges with many remote areas and also with the southern, central and western parts of Asia - the formation of the Silk Route.

Questions:

- (a) What has been the duty of god of walls and mounts?
- (b) Is Great Wall a single architectural structure? When was it built?
- (c) What was the role of great wall in the Chinese economy?
- (d) Write three sentence summary of the given paragraphs?
- (e) Give a suitable title of the given paragraphs.

2(a) Imagine that you have made a field trip. Write a report for your co-workers. 10

(b) "The Mother of a Traitor" is concerned with the theme of patriotism. Justify. 10

3/ Mark the primary stress on the following words: 5
ability, one-legged, condition, present(v), elemental, typify, report(n) enrolment, paragraph, municipal.

4. Mark the tone in the following sentences: 5
(i) He is intelligent.
(ii) Do you play or stay here?
(iii) When you go they will come.
(iv) No?
(v) Namaste!

5/ Change the following as indicated: 5
(i) He had pursued the same path. (into passive)
(ii) She said, "What did you mean by it?" (into indirect speech)
(iii) They said, "Help the poor." (into indirect speech)
(iv) This could never be accomplished. (into active)

(3)

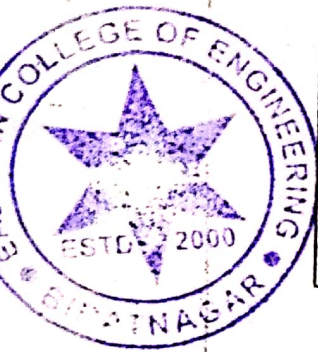
6/ What is non-verbal communication? Describe the fundamentals of effective speaking.

7/ Prepare a notice along with agenda for an annual meeting of organization you are involved in.

8/ Write an essay on any ONE:
(a) Importance of Library in a college
(b) Role of media in the development

9/ Prepare cover page, summary and conclusion of a report on role of civil engineers in Nepal to be submitted to the Ministry of Education.





PURBANCHAL UNIVERSITY

2018

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG103SH: Physics (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question each from Group A and D and TWO questions each from Group B and C.

Group A

- 1(a) Differentiate between compound and torsion pendulum. How would you determine the modulus of rigidity of given material using torsion pendulum? 8
- (b) Calculate the minimum intensity of audibility in watts per square cm from a note of 1000Hz. If the amplitude of vibration is 10^{-9} cm. Given density of air is 0.0013gm/c.c. and velocity of sound in air is 340m/s. 5
- 2(a) What are ultrasonics? Discuss the method of production of ultrasonic waves. Explain in brief the applications of ultrasonic wave. 1+5+2
- (b) A body is executing SHM with periodic time 3S. If the amplitude of the displacement is 8cm, then calculate maximum velocity and maximum acceleration? 5

Group B

- 3(a) Define cardinal points. Calculate the equivalent focal length of a combination of two thin lenses of focal length f_1 and f_2 , separated by a distance. 2+6
- (b) A Plano convex lens of radius 300 cm is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of 8th dark ring in the transmitted system is 0.72 cm. Calculate the wave length of light used. 5
- 4(a) What do you mean by coherent sources? Describe and explain the phenomenon of interference in thin film. 1+7

Contd. ...

(2)

- (b) A 20 cm long tube containing sugar solution rotates the plane of polarization by 12° . If the specific rotation is 65° , calculate the strength of solution? 5
- 5(a) What is polarization? How would you produce and detect linearly, circularly and elliptically polarized light? Give the mathematical theory. 1+7
- (b) The dispersive powers of crown and flint glasses are 0.015 and 0.030 respectively. Calculate the focal length of the lenses which form an achromatic doublet of focal length 60 cm when placed in contact. 5

Group C

- 6(a) Calculate the magnetic field due to a long straight conductor using Biot and Savart's law. 9
- (b) The inductance of closely packed coil of 400 turns is 8mH. What is the magnetic flux through the coil when the current is $5 \times 10^{-3}A$? 5
- 7(a) Define capacitance. Obtain an expression for capacitance of spherical capacitor. Explain the effect of dielectric on the capacitor. 9
- (b) Two charges 4 C and -1 C are placed at a distance r apart. A charge Q is placed exactly midway between them. What will be the value of Q so that charge -1C experiences no net force? 5
- 8(a) Derive an expression for the growth and decay of current in LR circuit. Explain the meaning of inductive time constant. 8+1
- (b) A copper wire of length 50 cm and area of cross-section $10^{-6}m^2$ carries a current of 1A. If the resistivity of copper is $1.8 \times 10^{-8} \Omega m$. Calculate electric field across the wire. 5

Group D

- 9(a) Write Maxwell's equations in integral form and convert them into differential form. 8
- (b) A $2\mu F$ capacitor is charged up to 50V. The charging battery is disconnected and 10mH coil is connected across capacitor so that LC oscillations will occur. Calculate the maximum value of current? 5

(3)

- 10(a) Define the terms free, damped and forced oscillation. Obtain an expression for energy stored in LC circuit at any time.
- (b) You are given a $1\mu F$ capacitor. How would you establish an instantaneous displacement current of 1A in the space between its plates?

PURBANCHAL UNIVERSITY

2017

B.E. (Civil)/Second Semester/ Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG103SH: Physics (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question each from Group A and D and TWO questions each from Group B and C.

Group A

1(a) What is compound pendulum? Derive its time period. In which condition time period is maximum and minimum. 1+4+3

(b) A sitar wire is under tension 30 N and the length of the bridges is 80cm. A 10metre sample of that wire has mass 2.2gm. Determine the speed of transverse wave on the wire and the frequency of fundamental. 5

2(a) Show that the intensity of sound wave is proportional to the square of the frequency of wave. 8

(b) When the displacement in SHM is half of the amplitude? What fraction of the total energy is kinetic? 5

Group B

3(a) Explain with necessary theory the Newton's rings method for the determination of wavelength of monochromatic light. What is blooming of lenses? 6+3

(b) In a plane diffraction grating the angle of diffraction for second order maxima for wavelength 600nm is 30°. Calculate the number of lines in one centimeter of the grating surface. 5

4(a) Give mathematical explanation of linearly, elliptically and circularly polarized light. Define optical activity and Laurent's half-shade polarimeter. 6+3

(b) Two thin convex lenses having focal length 0.05 m and 0.02 m are coaxial and separated by a distance of 0.03 m. find the equivalent focal length and the positions of principal points. 5

Contd. ...

(2)

- 5(a) Derive condition of achromatism of two thin lenses separated by a finite distance. Write some applications of laser light. 6+3
- (b) A wedge-shaped air film, having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance between the consecutive bright fringes is 1.25mm. Calculate the wave length of light used. 5

Group C

- 6(a) Define electric potential. Derive an expression for the electric potential due to an electric dipole. Differentiate between polar and non polar dielectrics? 1+4+3
- (b) Resistors of 4Ω and 12Ω are connected in parallel across a 6 V battery with an internal resistance of 1Ω . Find the total resistance of the circuit and the current in each resistor. 5
- 7(a) Define current and current density. Explain microscopic view of resistivity and show that $\rho = \frac{mv}{ne^2\lambda}$, where the symbols carry their usual meanings. 2+6
- (b) Two long parallel wires are 1.8 cm apart. What equal currents flow in the wires if the magnetic field halfway between them is to have a magnitude of 296 micro tesla? 5
- 8(a) Derive an expression for the growth and decay of current in LR circuit. Explain the meaning of inductive time constant. 6+2
- (b) A dielectric slab of thickness t is inserted between the plates of a parallel plate capacitor of plate separation d and area A . Find the new capacitance. 5

Group D

- 9(a) Compare electromagnetic oscillation with mass spring system. Setup differential equation of LCR damped oscillation and find ... 3+5

(3)

- (b) Assuming that all the energy from a 1000 watt lamp is radiated uniformly; calculate the amplitudes of electric and magnetic fields of radiation at a distance of 2 m from the lamp?
- 10(a) Write down Maxwell's equations in integral form and derive them in differential form.
- (b) An observer is at a distance of 1m from the point source of light whose power output is 2KW. Calculate the magnitude of electric and magnetic fields.

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PURBANCHAL UNIVERSITY

2016

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG103SH: Physics (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question each from Group A and D and TWO questions each from Group B and C.

Group A

$$\sqrt{\frac{2\ell g}{4\pi^2 B C}}$$

1(a) What is physical pendulum? Derive its time period. Show that point of suspension and oscillation are interchangeable. 1+4+3

(b) A motor car is approaching a road crossing with a speed of 75km/hr. A constable standing near the crossing hears the frequency of its horn 260Hz. What is the real frequency of the horn? The speed of sound in air = 332m/s. 5

2(a) Show that for a progressive wave particle velocity is the product of wave velocity and slope of the displacement curve. 4

(b) What are ultrasonic waves? Discuss briefly a method of production of such waves. 1+3

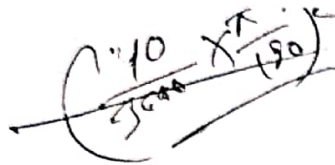
(c) A body is executing SHM with periodic time 3s. If the amplitude of the displacement is 8cm, then calculate maximum velocity and maximum acceleration. 5

Group B

3(a) Explain what is meant by chromatic aberration. Deduce the condition for a achromatism of two lenses separated by a distance. 2+7

Contd. ...

(2)



(3)

- (b) A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between the consecutive bright fringe is between the consecutive bright fringe is $1.2 \times 10^{-2} \text{m}$. Calculate the wavelength of light used. 5
- 4(a) Discuss the formation of Newton's rings by reflected light. Derive an expression for wavelength of monochromatic light in terms of diameter of rings and radius of curvature of the lens used. 5+4
- (b) In a plane transmission grating the angle of diffraction for second order principal maxima for the wavelength $5 \times 10^{-5} \text{cm}$ is 30° . Calculate the number of lines in one centimeter of the grating surface. 5
- 5(a) Give mathematical explanation of linearly, elliptically and circularly polarized light. What is optical activity and specific rotation? 6+3
- (b) Two thin convex lenses of focal lengths, 20cm and 5cm are placed 10cm apart. Calculate the positions of the principal points of this combination. 5

Group C

- a) Define electric flux. State and prove Gauss law in electrostatics. Apply this law to determine the electric field due to uniform spherical charge distribution. 1+3+4
- b) Show that P' the power per unit volume transformed into Joule heat in a resistor can be written as, $P' = J^2 \rho = E^2 / \rho$ 5
- c) What is current density and mobility? Explain atomic view of resistivity and develop a relation of resistivity in terms of mean free path of electrons. 2+2+4

- (b) In a hydrogen atom $5.3 \times 10^{-11} \text{m}$, and electron revolves round nucleus with a speed of $2.2 \times 10^6 \text{m/s}$. Calculate the magnitude magnetic field at the centre of the atom.
- 8(a) Prove that the time constant in LR-circuit is that time at which the current in the circuit will reach a value within $\frac{1}{e}$ of its equilibrium value.
- (b) Show that magnetic energy density is directly proportional to square of the magnetic flux density.
- (c) Calculate E, D and P: (a) in the dielectric, and (b) in the air gap. Use the following data : $K=7$, $A=100 \text{cm}^2$, $d=1 \text{cm}$, $V_0=100 \text{volts}$

Group D

- 9(a) What is electromagnetic oscillation? Compare it with mass-spring system. Setup differential equation of LC oscillation and find frequency of oscillation. 1+2
- (b) You are given 10mH inductor and two capacitors of $5 \mu\text{F}$ and $2 \mu\text{F}$ capacitances. What resonant frequencies can be obtained connecting these elements in various ways?
- 10(a) Derive Maxwell's equations in differential form.
- (b) Sun light strikes the earth outside its atmosphere with intensity of $2 \text{ cal/cm}^2\text{-min}$. Calculate E_m and B_m for sunlight

PURBANCHAL UNIVERSITY

2015

B.E. (Civil)/Second Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG103SH: Physics (*New Course*)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question each from Group A and D and TWO questions each from Group B and C.

Group A

- 1(a) Define Simple Harmonic Motion. Point out similarity and dissimilarity in the Bar pendulum and Torsional pendulum.
Derive an expression for time period of compound pendulum.
1+2+5
- (b) A particle is moving with SHM in a straight line. When the distance of the particle from equilibrium position has value X_1 and X_2 the corresponding values of velocity are V_1 and V_2 . Calculate the time period of SHM. 5
- 2(a) Derive an expression for velocity of transverse wave in stretched string. 5
- (b) Write some application of ultrasonic waves. 3
- (c) Calculate the speed of sound in the gas in which two sound waves of wavelength 1.0m and 1.01 m produced 4 beats per second. 5

Group B

- 3(a) What are cardinal point of a coaxial system? Explain 3
- (b) What is chromatic aberration in a lens? Derive conditions of achromatism when two lenses are separated by a finite distance. 1+5

Contd. ...

(2)

- (c) Two thin lenses having the power 0.5 D and 1.0 D are placed at a distance 20 cm apart. Calculate the power of equivalent lens of these two lenses. 5
- 4(a) What do you mean by coherent source of light. Write down the basic condition of interference of light. 1+2
- (b) Show that monochromatic light of interference patterns due to thin film of the reflected and transmitted light are complimentary. 6
- (c) Determine the angular separation between central maximum and first order maximum of the diffraction pattern due to a single slit of width 0.25 mm, when light of wavelength 5890 Å is incident on it normally. 5
- 5(a) Distinguish between Fraunhofer and Fresnel diffraction. 3
- (b) Give mathematical explanation of linearly, circularly and elliptically polarized light. 6
- (c) In a Young's double slit experiment, the width of the fringes obtained with light of wavelength 6000 Å is 2.0 mm. What will be the fringe width, if the entire apparatus is immersed in a liquid of refractive index 1.33? 5

Group C

- 6(a) Prove that the electric potential due to electric quadrupole is inversely proportional to the cube of distance. 5
- (b) State Gauss's law in free space. How the Gauss's law is modified if dielectric materials are present. 1+2
- (c) A parallel plate capacitor having plate area A and separation d is completely filled with two dielectrics each having thickness of d/2 and dielectric constant K_1 and K_2 . Calculate the capacitance of this capacitor. 5
- 7(a) Show that $J = nev_d$, where symbols carry their usual meanings. 3

Contd. ...

(3)

- (b) Explain microscopic view of resistivity and derive an expression for the resistivity of a conductor carrying current.
- (c) A B.E. student kept his 9.0 V, 7W radio turned on at full volume from 9.00 P.M. until 2.00 A.M. How much charge went through it?
- 8(a) State and explain Kirchoff's laws.
- (b) State Biot and Savart's law. Derive an expression for magnetic field due to straight conductor carrying current.
- (c) A coil has an inductance of 5 H and resistance of 20Ω. If a 100V emf is applied, what energy is stored in the magnetic field after the current has built up to its maximum value E/R.

Group D

- 9(a) What is damped oscillation? Develop a differential equation to describe LCR oscillation and also derive an expression for the frequency of LCR oscillation. 2
- (b) Prove that the relation $\nabla \cdot \vec{J} + \frac{\partial p}{\partial t} = 0$. Where p is charge density and \vec{J} is current density.
- 10(a) Write Maxwell's equations in integral form and convert them into differential form.
- (b) For a 50KW Kantipur FM radio, find the maximum magnitude of electric field and magnetic field at a distance of 100 Km from antenna. Assume that the antenna radiates equally in all directions.

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PURBANCHAL UNIVERSITY

2014

B.E. Civil/Second Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG103HS: Physics

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer SIX questions, selecting ONE question each from Group A and D and TWO questions each from Group B and C.

Group A

1(a) Define angular S.H.M. What is torsional pendulum? Derive an expression for the modulus of rigidity of the suspension wire.

1+1+6

(b) An observer travelling with a constant velocity of 20ms^{-1} , passes close to a stationary source of sound and notices a change of frequency of 50Hz as he passes the source. What is the frequency of the source? (Speed of sound in air = 340ms^{-1}).

-42.27
1/2

2(a) Derive an expression for the velocity of transverse waves in a stretched string.

4

(b) What is ultrasonic wave? Discuss a method for the production of ultrasonic wave.

4

(c) A linear spring whose force constant is 0.2N/m hangs vertically supporting a 1kg mass at rest. The mass is pulled down a distance 0.2m and then released. What will be its maximum velocity? Also find the frequency of vibration.

5

Group B

3(a) What is interference of light? Obtain the expression for the radius of n th dark ring in the reflected system of Newton's ring experiment.

1+5

(b) What is blooming of lens? Explain.

3

(c) In a plane transmission grating the angle of diffraction for second order maxima for wavelength $5 \times 10^{-5}\text{cm}$ is 30° . Calculate the no. of lines in one centimeter of the grating surface.

5

Contd. ...

(2)

- 4(a) What is optical activity and specific rotation? 4
- (b) What is birefringence? Discuss the birefringence in Nicol's prism. 5
- (c) Two glasses have dispersive powers in the ratio 2:3. These glasses are to be used in the manufacture of an achromatic objective of focal length 20cm. What are the focal lengths of the lenses? 5
- 5(a) What is chromatic aberration in a lens? Derive an expression for condition of achromatism of two thin lenses placed at a finite separation. 1+4
- (b) What is optical fibre and what are their types. 4
- (c) In Newton's rings experiment the diameter of the 4th and 12th rings are 0.4cm and 0.7cm respectively. Find the diameter of the 20th dark ring. 5

Group C

- 6(a) What is electric dipole? Develop an expression for the electric potential at a point lying anywhere in the field of a short electric dipole. 1+4
- (b) Derive expression for a parallel plate capacitor of plate separation d if a dielectric slab of thickness t is introduced between the plates ($t < d$). 3
- (c) Three charges $+1 \times 10^{-7}C$, $-4 \times 10^{-7}C$ and $+2 \times 10^{-7}C$ are placed at the three vertices of an equilateral triangle of side 0.1m. Find the minimum amount of work required to dismantle this structure. 5
- 7(a) Explain atomic view of resistivity and show that $\rho = \frac{mv}{ne^2 \lambda}$, where symbols carry their usual meanings. 5
- (b) State and explain Kirchoff's laws. 3
- (c) A solenoid has an inductance of 53mH and a resistance of 0.37Ω . If it is connected to a battery, how long will it take for the current to reach half of its final value? 5

Contd. ...

(3)

- 8(a) What are intrinsic and extrinsic semiconductors? Explain Describe how a P-N junction diode can be used as rectifier. 3
- (b) A coil circular turns has a length of 50cm and diameter 3cm, the number turns in the coil is 1000, find its self-inductance.

Group D

- 9(a) What are electromagnetic oscillations? Set up differential equation for undamped oscillations and find the frequency. 2
- (b) In free space prove that the magnetic energy density is equal electric energy density.
- 10(a) Write Maxwell's equations in integral form and convert them in differential form. 2
- (b) A 1200PF capacitor is charged to a 500V battery. It is disconnected from the battery and is connected to a 75mH inductor at $t=0$. Determine (i) the initial charge on the capacitor (ii) the maximum current (iii) the frequency and period of oscillation (iv) the total energy oscillating in the system.

Handwritten calculations:

$$\begin{array}{r} 18 \\ -32 \\ \hline 16 \end{array}$$

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PURBANCHAL UNIVERSITY

2013

B.E. Civil/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG103HS: Physics

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer **SIX** questions, selecting **ONE** question from Group A and D and **TWO** questions from Group B and C.

Group A

- 1(a) What is compound pendulum? Derive its time period and show that points of suspension and oscillation are interchangeable. 1+4+3
- (b) The displacement equation of a transverse plane wave at any instant is given by $y = 0.03 \sin(3\pi t - 0.03\pi x)$ where x and t are in metre and seconds. Calculate, wavelength, frequency and velocity of the wave. Also calculate phase difference between two particles 0.05m apart at same instant. 5
- 2(a) What is Doppler's effect? Find an expression for change in frequency of a note when source is moving towards a stationary listener. 1+3
- (b) What are ultrasonics? Discuss a method for the production of ultrasonic waves. 1+3
- (c) A particle is executing S.H.M. whose amplitude and frequency are 0.15 m and 4Hz respectively. Calculate,
(i) maximum acceleration and
(ii) velocity when the displacement is 0.1m 5

Group B

- 3(a) Show that interference patterns in thin film due to reflected and transmitted light are complementary to each other. 9
- (b) In a plane transmission grating the angle of diffraction for second order maxima for wavelength 5×10^{-5} cm is 30° . Calculate the no. of lines in one centimeter of the grating surface. 5

Contd. ...

(2)

- 4(a) What is double refraction? Give mathematical explanation of linearly, circularly and elliptically polarized light. 3+6
- (b) Two glasses have dispersive powers in the ratio 2:3. These glasses are to be used in the manufacture of an achromatic objective of focal length 20cm. What are the focal lengths of the lenses? 5
- 5(a) Derive an expression for equivalent focal length of two thin lenses separated by a finite distance. Also calculate the positions of principal points. 6+3
- (b) In Newton's rings experiment the diameter of the 4th and 12th rings are 0.4 cm and 0.7 cm respectively. Find the diameter of the 20th dark ring. 5

Group C

- 6(a) Define electric flux. What is electric dipole and dipole moment? Derive an expression for the electric field intensity at a point on equatorial line of a short dipole. 1+1+6
- (b) A hollow copper tube of 5 m length has external diameter equal to 10 cm and its wall is 5 mm thick. Find its resistance if the specific resistance of copper is $1.7 \times 10^{-8} \Omega \text{ m}$. 5
- 7(a) Show that $\sigma = ne\mu$, where symbols carry their usual meanings. 3
- (b) Explain atomic view of resistivity and show that $\rho = \frac{mv}{ne^2 \lambda}$, where symbols carry their usual meanings. 5
- (c) Two long parallel wires are 8.1 cm apart. What equal current flow in the wires if the magnetic field halfway between them is to have a magnitude of 296 μT ? 5
- 8(a) Derive an expression for the growth and decay of current in LR circuit. Explain the meaning of inductive time constant. 8
- (b) Two dielectric slabs are inserted between the plates of a parallel plate capacitor. The thickness of the slab with dielectric constant K_1 is d_1 and that of K_2 is d_2 . The separation between the plates of capacitor is $d = d_1 + d_2$. If the area of the plate is A , calculate the capacitance of the arrangement. 5

(3)

Group D

- 9(a) What is electromagnetic oscillation? Setup differential equation of LC oscillation and find the frequency of oscillation. 1+5
- (b) Calculate the pointing vector and the amplitude of electric field if a laser beam of 500W is concentrated using a lens on a cross-sectional area of 10^{-10} m^2 . Given $\epsilon_0 = 9 \times 10^{-12} \text{ Fm}^{-1}$. 5
- 10(a) Write Maxwell's equations in integral form and convert them into differential form. 3
- (b) Prove the charge conservation theorem 5

$$\nabla \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$$

PURBANCHAL UNIVERSITY

2012

B.E. Civil/Second Semester/Choice

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG103SH: Physics (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

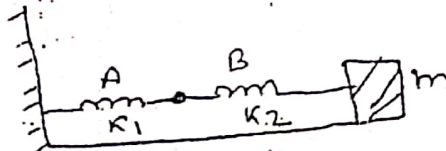
Answer SIX questions, selecting ONE question from Group A and D and TWO questions from Group B and C.

Group A

1(a) Write down the characteristics of simple harmonic motion. Derive an expression for the time period of a compound pendulum and show that the points of suspension and oscillation are interchangeable. 2+4+2

1 (b) Two springs A and B having force constant k_1 and k_2 are attached to a block of mass m as shown in Figure. Show that the frequency of oscillation on the frictionless surface is given by

$$f = \frac{1}{2\pi} \sqrt{\frac{k_1 k_2}{m(k_1 + k_2)}}$$



2(a) How are ultrasonic waves produced and detected? How these waves are used to detect cracks in metals. Mention some of the properties of ultrasonic waves? 4+2+2

(b) If the intensity of wave is $1 \times 10^6 \text{ w m}^{-2}$ at 50km from a source, what is the intensity at 10km from the source? 5

Group B

3(a) What is meant by achromatism? Find the condition for achromatism of two thin lenses separated by a distance. 1+4

(b) What are cardinal points? Explain each of them with suitable diagram. 1+3

Contd. ...

(2)

(c) What is the highest order of diffraction which may be seen with monochromatic light of wavelength 6000Å by means of a plane diffraction grating with 5000 lines per cm. 5

(a) What are Newton's rings? How are these obtained? Describe a necessary theory of Newton's rings method for the determination of refractive index of given transparent liquid. 1+1-7

(b) Find the specific rotation of a given sample of sugar solution if the plane of polarization is turned through 28°. The length of the tube containing 25% of sugar solution is 30cm. 5

5(a) What is the physical principle behind the functioning of an optical fiber? 4

(b) Write down the characteristics of a laser beam. Also, explain the main applications of laser in various fields. 5

(c) A thin convex lens and another thin concave lens each of focal length 20cm are coaxially placed at a distance of 7cm. Find the combined power and the positions of the two principal points. 5

Group C

6(a) Show that the electric field due to a short electric dipole at an axial point is inversely proportional to the cube of its distance from the dipole. 5

(b) Prove that magnetic energy-density is directly proportional to the square of the magnetic flux density. 4

(c) A dielectric slab of thickness b is inserted between the two plates of a parallel plate capacitor of plate separation d . Show that their new capacitance is given by $C = \frac{k\epsilon_0 A}{kd - b(k-1)}$. 5

(a) What is current density and mobility? Explain the atomic view of resistivity and show that $\rho = \frac{m}{ne^2\tau}$. 8/

b) If a resistance of a wire of length 120cm and diameter 0.4mm is found to be 2.5Ω. What is the specific resistance of the materials of the wire? 5

Contd. ...

(3)

8(a) State and explain Ampere's theorem. Derive an expression for the magnetic field due to a long solenoid carrying current.

(b) A circular loop of wire 5cm of radius carries a current of 100A. What is the energy density at the center of the loop?

Group D

9(a) Define electromagnetic oscillation and compare it with SHM. Derive a differential equation of LC oscillation and find the frequency of oscillation. 3-

(b) If the supply voltage were 10V, the frequency 1 KHz and capacitance 2μF; what value of R in the circuit would allow a current of 0.1A to flow?

10(a) What are Maxwell's equations in integral form? Giving necessary theory, derive Maxwell's equations in differential form. 8

(b) An observer is at a distance of 1m from the point source of light whose output power is 5kW. Calculate the magnitude of electric and magnetic fields. 5

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PURBANCHAL UNIVERSITY

2018

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG157CI: Applied Mechanics-II (Dynamics) (New Course)

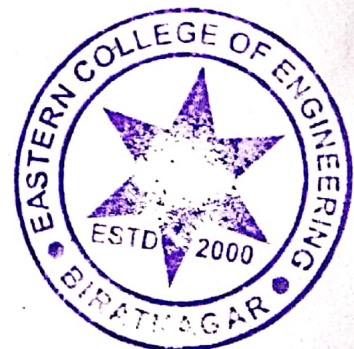
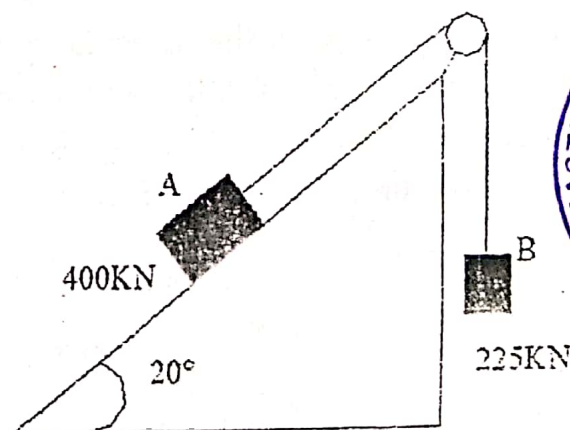
Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

- 1(a) Derive the relation for radial and transverse component of velocity and acceleration of the particle when the particle is moving in curvilinear path. 8
- (b) A motorist is travelling at 45 mile/hr when he observes that a traffic light 800ft ahead of him turns red. The traffic light is timed to stay red for 15 sec. if the motorist wishes to pass the light without stopping just as it turns green again, determine (i) the required uniform retardation of the car, (ii) the speed of the car as it passes the light. 8
- 2(a) Prove that 'when a particle is under the action of central force angular momentum is conserved'. 6
- (b) Two blocks shown in figure start from rest. The pulleys are frictionless and having no mass. The kinetic coefficient of friction between the block A and the inclined plane is 0.25. Determine the acceleration of each block and the tension in each block. 10



Contd. ...

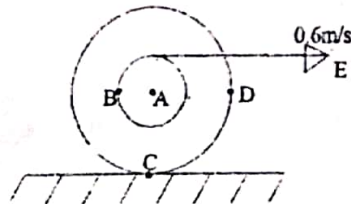
(2)

3(a) What do you mean by principle of impulse and momentum for a system of particle? Illustrate the relation for the conservation of momentum. 6

(b) A ball is thrown against a frictionless, vertical wall. Immediately before the ball strikes the wall, its velocity has a magnitude v and forms an angle of 30° with the horizontal. Knowing that $e=0.9$, determine the magnitude and direction of the velocity of the ball as it rebound from the wall. 10

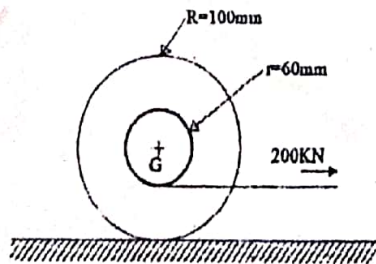
4(a) What do you mean by general plane motion of the rigid body? Illustrate with an example. 6

(b) A drum of radius 120mm is mounted on a wheel of radius 180mm as in figure, where a rope is wound around a drum. The end E of the rope is pulled with a constant velocity $V_E = 0.6\text{m/s}$ and the wheel rolls without slipping. Using velocity center, determine (i) V_D of the point D, (ii) the rate at which the rope is being wound or unwound. 10



5(a) What do you understand by Coriolis acceleration? Obtain the expression containing Coriolis acceleration. 6

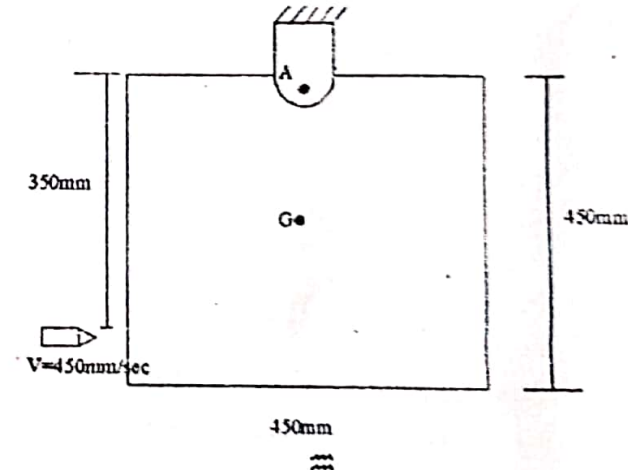
(b) A cord is wrapped around the inner drum of a wheel and pulled horizontally with a force of 200N. The wheel has a mass of 50Kg and a radius of gyration of 70mm. Knowing that $\mu_s=0.2$ and $\mu_k=0.15$, determine the acceleration of G. 10



(3)

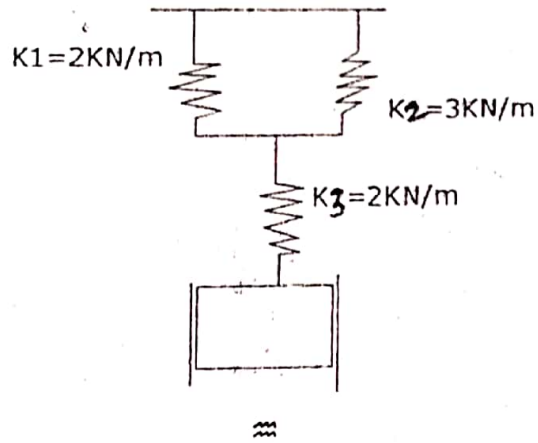
6(a) What do you mean by undamped forced vibration? Obtain the expression for magnification factor for this case. 2+4

(b) A 20gm bullet B is fired with a horizontal velocity of 450m/s into the side of a 10 kg square panel suspended from a hinge at A. knowing that the panel is initially at rest, determine (a) the angular velocity of the panel immediately after the bullet becomes embedded, (b) the impulsive reaction at A, assuming that the bullet becomes embedded in 0.0006 sec. 10



(4)

- (b) A 75 kg block moves between vertical guides. The block is 50mm down and released. Determine the period, frequency vibration, maximum velocity and maximum acceleration of v. 10



PURBANCHAL UNIVERSITY

2017

B.E. (Civil)/Second Semester/ Final

Time: 03:00 hrs. Full Marks: 80/Pass Marks: 32

BEG157CI: Applied Mechanics-II (Dynamics) (New Course)

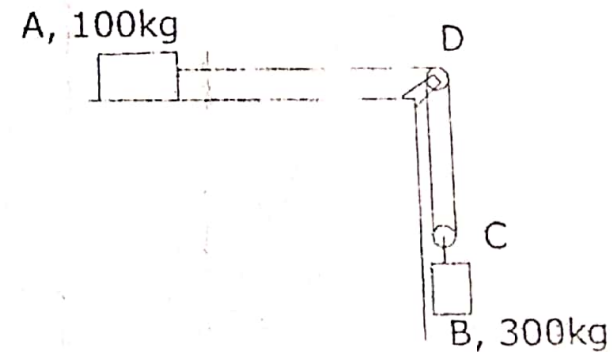
Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

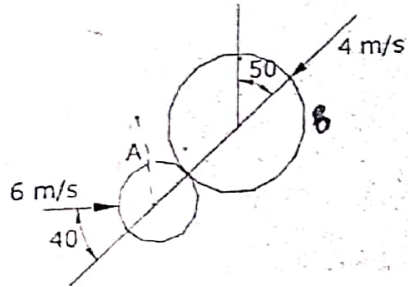
- 1(a) Discuss shortly on the graphical method of solution of rectilinear motion problems. 6
- (b) Ball 'A' is released from rest at a height of 20m. After 1 second, a second ball 'B' is thrown upward from the ground. If the two balls pass one another at a height of 6m, determine: 10
- (i) speed at which the ball B was thrown upward,
 - (ii) speed of each ball when they pass
- 2(a) What are the tangential and normal components of acceleration with reference to the curvilinear motion? Derive. 6
- (b) The two blocks shown start from rest. The horizontal plane and the Pulley are frictionless and the pulley is assumed to be of negligible mass. Determine the acceleration of each block and the tension in each cord. 10



Contd. ...

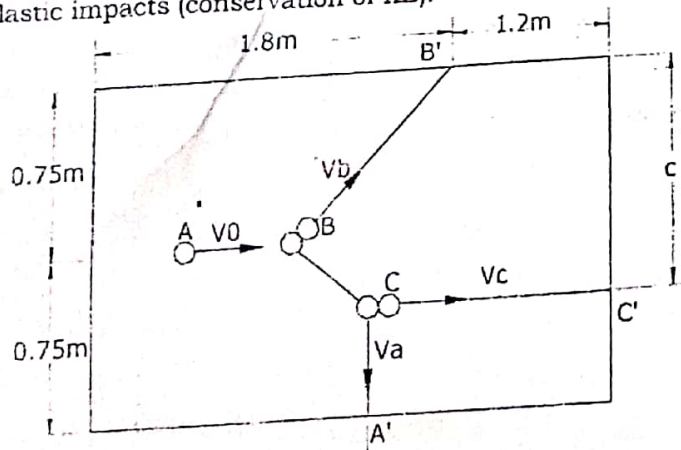
(2)

- 3(a) Define angular momentum of a particle and show that rate of change of angular momentum is equal to the sum of moments of forces acting on the particle about the point of rotation. 6
- (b) The initial velocities and their directions of the balls are as shown in fig. determine the final velocities and the directions after impact. Take $e = 0.8$. Mass of ball A = 600g. mass of B = 1 kg. 10



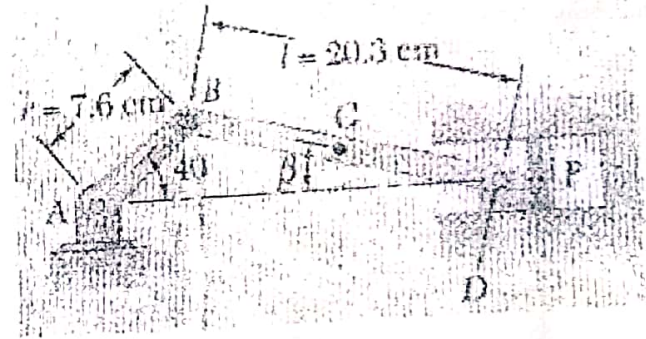
- 4(a) For a system gaining or losing mass, show that $\Sigma F + P = ma$, where P is the thrust. 6

- (b) In the game of billiards, the ball A first hits the ball B and then C. A', B', C' are the points where the balls hit correspondingly. If $v_0 = 4 \text{ m/s}$, $v_A = 1.92 \text{ m/s}$, and $a = 1.65 \text{ m}$, determine (i) the final velocities of the balls B and C, (ii) the point C' where the ball hits the side of the table. Assume frictionless surface and perfectly elastic impacts (conservation of KE). 10



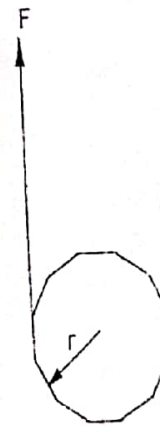
(3)

- 5(a) Derive for the Coriolis acceleration in plane motion.. 6
- (b) In the engine system shown in fig below, the crank AB has a constant clockwise angular velocity of 2000 rpm. For the crank position indicated, determine (i) the angular velocity of the connecting rod BD, (ii) the velocity of the piston P. 10



- 6(a) Discuss on D'Alembert's principle for plane motion of rigid. 2+

- (b) A cord is wrapped along the homogeneous disk of radius $r = 0.5 \text{ m}$ of mass 20 kg. If the cord is pulled upward with a force F determine (i) the acceleration of the centre of the disk, (ii) the acceleration of the disk, (iii) acceleration of the cord. 1



- 7(a) Derive the Kinetic energy for rigid body in plane motion.

contd.

(4)

- 1) A 50 kg block moves between vertical guides as shown in Fig. E. the block is pulled 40 mm down from its equilibrium position and released. Determine (a) period of vibration; (b) maximum velocity of the block; (c) maximum acceleration of the block. 10

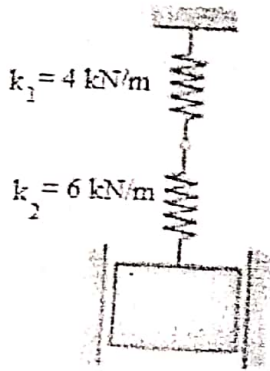


Fig. E



PURBANCHAL UNIVERSITY

2016

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG157CI: Applied Mechanics-II (Dynamics) (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

- 1(a) Deduce the relation for tangential & normal components of velocity and acceleration when a particle is undergoing a curvilinear motion. 6

- 2 (b) Three blocks A, B and C are connected by cords and pulleys as shown in Fig. A. At the instant shown, the velocities & accelerations of blocks A and B are 2m/sec (↓), 1m/sec² (↑); 3m/sec (↑) 2m/sec² (↑) respectively. Determine the velocity and acceleration of block C. 10

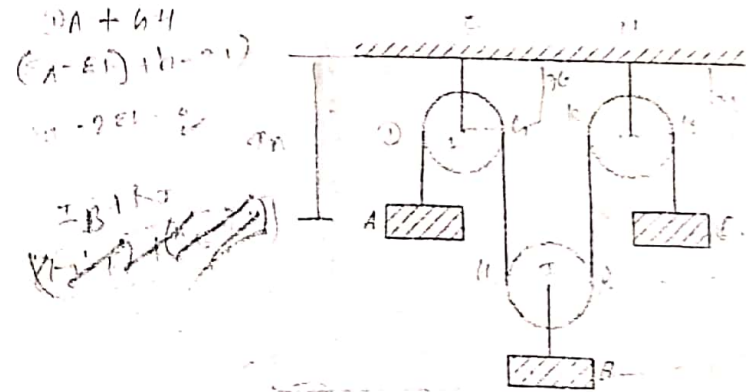


Fig. A

- 2(a) Define impact and impulse. Mention types of impact with neat sketch. 6

Contd. ...

(2)

(b) A soviet satellite "Sputnik" was launched 600 km from the surface of the earth, with an initial velocity of 30 Mm/hr acting parallel to the tangent at the surface of the earth. Assuming that the radius of earth is 6378 km & that its mass is 5.976×10^{24} kg, determine (a) the eccentricity of the orbital path & (b) the velocity of Sputnik at apogee. Comment on the path of the orbit. 10

3(a) Explain Translation, Rotation and General plane motion with Lable in figure. 6

(b) A rocket of initial mass m_0 (including shell & fuel) is fired vertically as shown in Fig. B, at time $t = 0$ sec. The fuel is consumed at a constant rate of $q = dm/dt$ and is expelled at a constant speed u relative to the rocket. Derive as expression for the velocity of the rocket at the time t , neglecting the air resistance). 10



Fig. B

4(a) Describe an expression for Impulsive force generated when you are dealing with system of variable mass. 6

(b) The double gear shown in Fig. C rolls on the stationary lower rack. The velocity of its centre A is 1.2 m/sec directed to the right. Determine (a) the angular velocity of the gear; (b) the velocities of the upper rack R and of point D of the gear. 10

Contd. ...

(3)

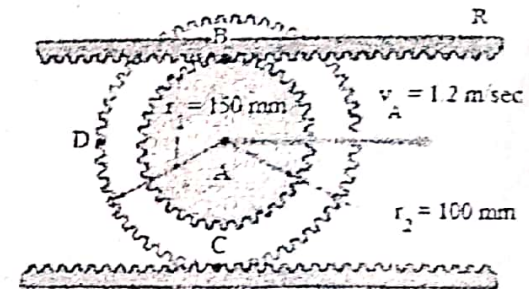


Fig. C

5(a) State d'Alembert's principle for plane motion of a rigid body. Write down the equations of motion for kinetics of rigid body.

(b) A sphere, a cylinder, and a hoop; each having the same mass and the same radius; are released from rest on an inclined. Determine the velocity of each body after it has rolled through a distance corresponding to a change in elevation h . (See Fig. D). 10

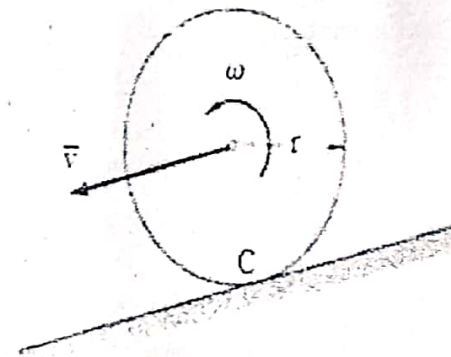


Fig. D

6(a) Discuss the motion under the central force. Derive an expression for Kepler's second law. 20

Contd. ...

PURBANCHAL UNIVERSITY

2015

B.E. (Civil)/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG157CI: Applied Mechanics-II (Dynamics) (New Course)

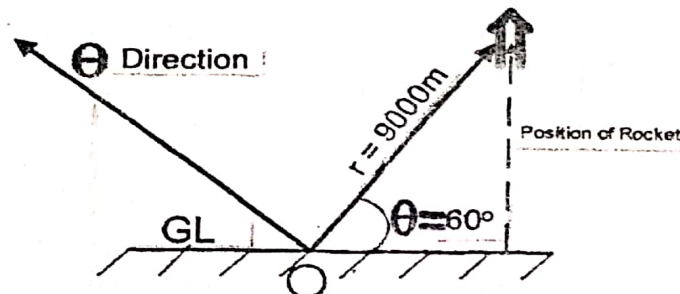
Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

- 1(a) What do you mean by "Determination of the motion of particles"?
Derive an expression for position of a particle "when acceleration is a given function of position". 2+4
- (b) A rocket is fired vertically and tracked by a radar station at O as shown in Fig. 1 (b). When θ is 60° , it is found that $r=9000\text{m}$, first derivative and second derivative of θ with respect to time are 0.02rad/sec and 0.002rad/sec^2 respectively. Determine the velocity and acceleration of the rocket at that instant. 10

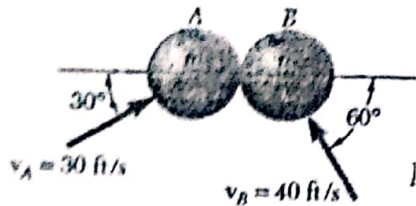


- 2(a) Differentiate among Newton's Second Law of Motion, Work-Energy Principle and Impulse-Momentum Principle for "Kinetics Analysis of Particles" with their scopes of application. Give necessary derivations for these three principles using usual notation. 6
- (b) The magnitude and direction of the velocities of two identical frictionless balls before they strike each other are shown in

Contd. ...

(2)

Fig 2(b). Assuming coefficient of restitution of 0.9, determine the magnitude and direction of the velocities of each ball after the impact. Calculate the loss in K.E. due to impact. 10



3(a) Derive expressions for the angular momentum about mass centre and its rate change for a system of particles with usual notations. 4+2

(b) A jet airplane is moving with a speed of 600 mile/hr in level flight. Each of its jet engines scoops in air at the rate of 180 lb/sec and ejects it with a speed of 2000 ft/sec relative to airplane. Neglecting the effect of fuel consumption, determine for each jet engine: (i) the magnitude of the propulsive force generated and (ii) the total horsepower generated relative to the ground. Refer figure 3(b). 6+4

4(a) Define the terms: translation, rotation and general plane motions. State and explain D'Alembert's principle for plane motion of rigid body. 3+3

(b) For the disk mounted on the arm, the indicated angular rotation rates are constant. Refer figure 4(b). Determine: (i) the velocity of the point P, (ii) the acceleration of the point P, and (iii) angular velocity and angular acceleration of the disk. 10

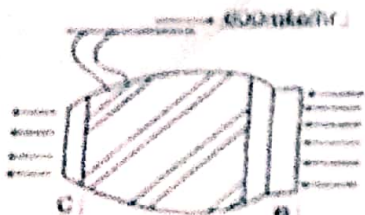


Figure 3(b)

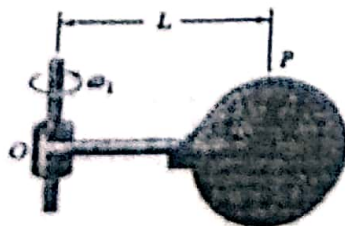


Figure 4(b)

Contd. ...

(3)

5(a) A cord is wrapped around the inner drum of a wheel and pulled horizontally with a force of 200N. The wheel has a mass of 50 kg and a radius of gyration of 70 mm. By checking whether the rolling without sliding is feasible or not, knowing that $\mu_s = 0.2$ and $\mu_k = 0.15$, determine the acceleration of G and the angular acceleration of the wheel. Refer figure 5(a).

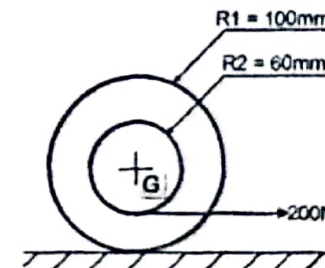


Figure 5(a)

(b) A 15 kg slender rod AB is 1.5 m long and is pivoted about a point O which is 0.3 m from end B. The other end is pressed against a spring of constant $K = 300 \text{ kN/m}$ until the spring is compressed 25 mm. The rod is then in a horizontal position. If the rod is released from this position, determine its angular velocity and the reaction at the pivot O as the rod passes through a vertical position. Refer figure 5(b).

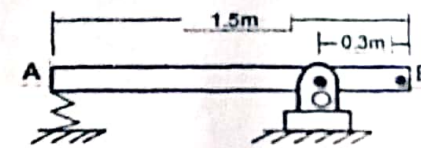


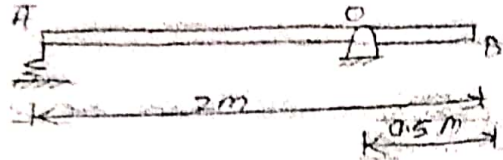
Figure 5(b)

6(a) Differentiate between the Kinetics and Kinematics study of particles. Explain the Undamped Free Vibration of Particles and derive an expression for the same. 2

(b) A satellite is launched in a direction parallel to the surface of the earth with the velocity of 36900 km/hr, at an altitude of 500 km. Determine: (i) the maximum altitude reached by the satellite and (ii) the periodic time of the satellite. Take $R = 6370 \text{ km}$.

==

(4)
 A 13kg slender rod AB is 2m long and is pivoted about a point O which is 0.5m from end B. The other end is pressed against a spring of $K = 350\text{N/m}$ until the spring is compressed 20mm. The rod is then horizontal position. If the rod is released from this position, determine its angular velocity and the reaction at point O' as the rod passes through a vertical position. 10



PURBANCHAL UNIVERSITY

2014

B. E. (Civil)/Second Semester/Final

Time: 03:00 hrs. Full Marks: 80/Pass Marks: 32

BEG157CI: Applied Mechanics-II (Dynamics) (New Course)

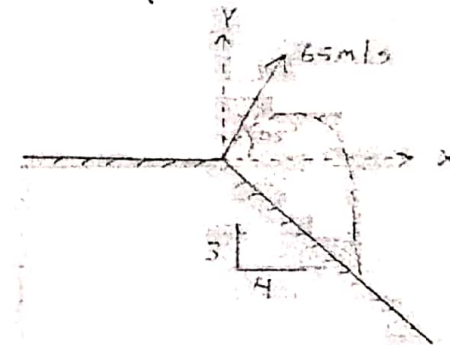
Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

1(a) Deduce the relation for tangential and normal components of acceleration when a particle is moving curvilinearly. 6

(b) A particle is projected at an angle of 45° with an initial velocity of 65m/s as shown in fig. Find the sloping distance covered by it. 10



2(a) Show that the rate of change of angular momentum of the particle about the origin 'O' at any instant is equal to the moment of force \vec{F} acting on the particle about the same point 'O'. 6

(b) A satellite is launched in a direction parallel to the surface of earth with a velocity 37,000 km/hr from an altitude 600km. Determine (i) the maximum altitude reached by the satellite. (ii) the periodic time of satellite.

Use radius of earth $R = 6370\text{km}$.

529.1359,

10

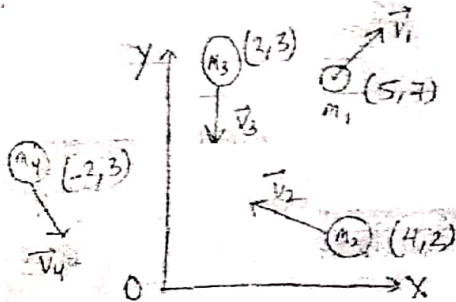
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- 3(a) Derive an expression for kinetic energy for system of particles. 6
 (b) A system of particles is shown in fig at time t moving in the xy plane. The following data should apply. 10

$m_1 = 2\text{kg}$ $\vec{v}_1 = 4\hat{i} + 4\hat{j}$ m/s
 $m_2 = 0.5\text{kg}$ $\vec{v}_2 = -3\hat{i} + 6\hat{j}$ m/s
 $m_3 = 3\text{kg}$ $\vec{v}_3 = -5\hat{j}$ m/s
 $m_4 = 0.8\text{kg}$ $\vec{v}_4 = 2\hat{i} - 7\hat{j}$ m/s

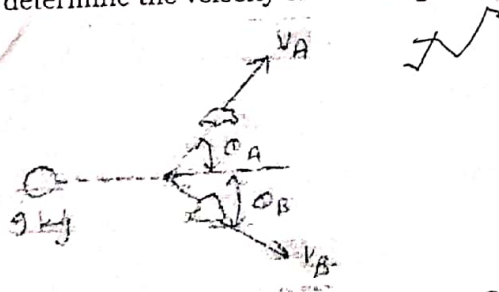
Determine:

Total moment of momentum about pt (2, 8).



- 4(a) Define instantaneous centre of rotation with examples and also define translational motion of the rigid body. 4+2

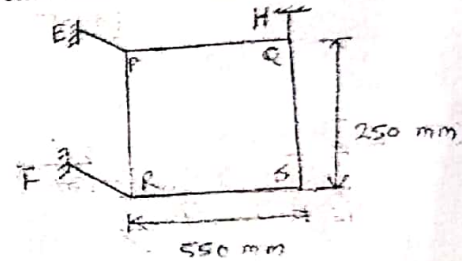
- (b) A 9 kg projectile is moving with a velocity of 30.5m/s when it explodes into two fragments A & B, weighing 2.3kg and 6.7kg respectively, knowing that immediately after the explosion, fragments A to B travel in directions defined respectively by $\theta_A = 45^\circ$ and $\theta_B = 30^\circ$, determine the velocity of each fragment. 10



Contd. ...

- 5(a) Deduce the expression which shows the relation for the force exerted by the vane on the stream while you are dealing with the steady stream of particles. 6

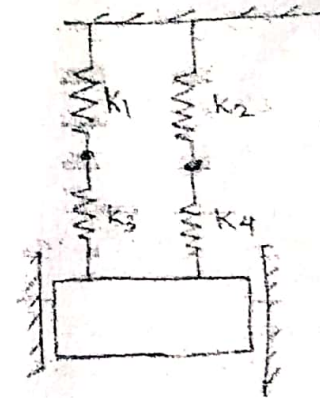
- (b) The thin plate PQRS has a mass of 1.2kg and is held in the position shown by wire QH and two links PE & RF. Neglecting the mass of links determine immediately after wire QH has cut.
 (i) the acceleration of the plate
 (ii) force in each link 10



- 6(a) Explain the principle of impulse & momentum for the planar motion of rigid body. 6

- (b) A 60kg block moves between vertical guides as shown in fig. The block is pulled 35mm down from its equilibrium position and released. Determine the period of vibration, maximum acceleration of block. 1

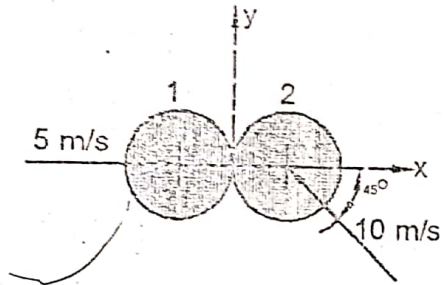
Given $K_1 = 5\text{KN/m}$, $K_2 = K_3 = K_4 = 6\text{KN/m}$.



- 7(a) What do you mean by constrained motion in the plane? Give applications of rigid body motion in the plane. 6

Contd.

- (2)
- 4[a] What do you mean by principle of impulse and momentum for a system of particles? Illustrate the relation for the conservation of momentum. [6]
- [b] Two balls of same size and mass collide with the velocities of approach as shown in figure. For a coefficient of restitution of 0.9, what are the final velocities of the balls after impact? What is the loss of K.E. and where does this energy go? [10]



- [a] What do you mean by general plane motion of rigid body? Illustrate with an example. Define instantaneous center of rotation with example. [6]
- [b] While crossing in level flight at a speed of 913.3 km/h, a jet airplane scoops in air at a rate of 108.86 kg/s and discharges it with a velocity of 670.56 m/s relative to the airplane. Determine (i) the power actually used to propel the airplane, (ii) the total power developed by the engine, (iii) the mechanical efficiency of the airplane. [10]
- a] What do you mean by Undamped force vibration? Obtain the expression for magnification factor for this case. [6]
- b] Load B is connected to a double pulley by one of the two inextensible cables shown. The motion of the pulley is controlled by a cable C, which has a constant acceleration of 22.8 cm/s² and an initial velocity of 30.48 cm/s, both directed to the right. Determine (i) the number of revolutions executed by the pulley in 2 s, (ii) the velocity and change in position of the load B after 2 s, and (iii) the acceleration of point D on the rim of the inner pulley at $t = 0$. [10]

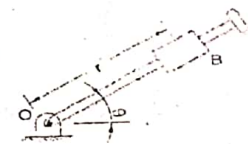
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Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

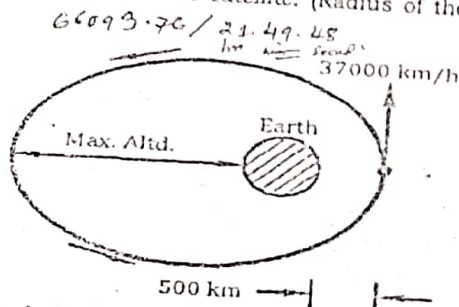
- 1(a) Derive expressions for tangential and normal components of acceleration when a particle is moving along a curve path. 6
- 2(a) A ball is thrown vertically upward from the 13m level in an elevator shaft with an initial velocity of 20m/s. At the same instant an open platform elevator passes the 5.5m level, moving upward with a constant velocity of 2 m/s. Determine (a) when and where the ball will hit the elevator, (b) the relative velocity of the ball with respect to the elevator when the ball hits the elevator. 4.05/13.60/-21.69 m/s. 10
- 3(a) Define linear momentum and angular momentum. Prove that "when a particle moves under a central force, its areal velocity is constant".
- (b) The rotation of the 1.0m arm OA about O is defined by the relation $\theta = 0.2t^2$, where θ is expressed in radians and t in seconds. Collar B slide along the arm in such a way that its distance from O is $r = 1.0 - 0.12t^2$, where r is expressed in meters and t in seconds. After the arm OA has rotated through 30°, determine (a) the total velocity of the collar, (b) the total acceleration of the collar, (c) the relative acceleration of the collar with respect to the arm. 10



Contd. ...

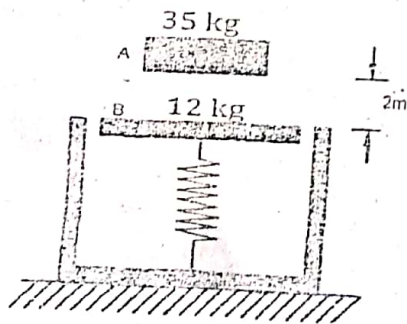
3(a) "Kinetic energy of the system is conserved in the case of perfectly elastic collision". Justify it. 6

3(b) A satellite is launched in a direction parallel to the surface of the earth with a velocity of 37000 km/h from an altitude of 500 km. Determine (a) the maximum altitude reached by the satellite, (b) the periodic time of the satellite. (Radius of the earth is 6370 km) 10



3(a) Show by derivation that resultant moment of all externally applied forces about point 'O' is equal to the rate of change of angular momentum about same point, for system of particles. 6

3(b) A 35 kg block is dropped from a height of 2m onto the 12 kg pan of a spring scale. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is $k = 20 \text{ kN/m}$. 10



Contd. ...

(3)

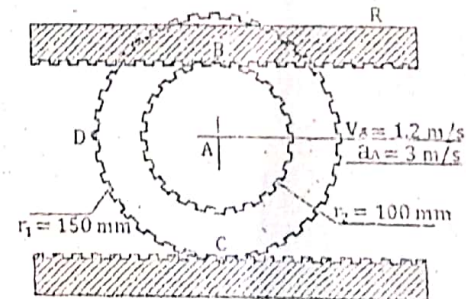
5(a) Define general plane motion. When the rigid slab is in translation all the points of the slab have the same velocity and acceleration at any given instant. Justify this statement. 6

5(b) A nozzle discharges a steam of water of cross sectional area $A = 100 \text{ mm}^2$ with a speed $v = 50 \text{ m/sec}$ and the steam is deflected by a fixed vane as shown in fig 5(b). The mass density of water $\rho = 103 \text{ kg/m}^3$. Determine the resultant force \vec{F} exerted on the steam by the fixed vane. 10



6(a) What do you mean by Undamped forced vibration? Obtain the expression for magnification factor for this case. 6

6(b) The center of the double gear has a velocity of 1.2 m/s to the right and an acceleration of 3 m/s^2 to the right. Recalling that the lower rack is stationary, determine (a) the angular acceleration of the gear, (b) the acceleration of point B, C, and D of the gear. 10



6(a) What do you mean by d'Alembert's principle for the plane motion of a rigid body? 6

Contd. ...

PURBANCHAL UNIVERSITY

2012

B. E. (Civil)/Second Semester/Chance

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG157CI: Applied Mechanics-II (Dynamics) (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

1(a) Derive the formulae for velocity and acceleration of a particle in radial and transverse component system when the particle is moving along a curvilinear path. 6

(b) A particle moves along a straight line such that $a = -6 + 3t \text{ m/s}^2$

(i) Find the initial velocity such that particle's position at $t=0$ sec is the same as the position at $t=4$ sec. 10

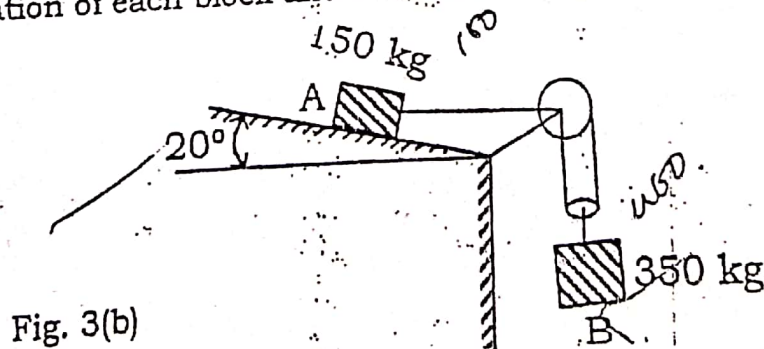
(ii) What is the velocity of particle at $t=4$ sec? 10

2(a) Deduce the expression for trajectory of a particle moving under a central force. 6

(b) The relation for r and for the motion of a particle is given by $r = \theta^2$ and $\theta = t^2$ where r is in metres, θ is in radians and t is in sec. Find the velocity and acceleration when $\theta = 0.3$ radian. 10

3(a) Define oblique impact. How the problems related to oblique impact can be analysed? 6

(b) Two blocks shown in Fig. 3(b) start from rest. The pulleys are frictionless and having no mass. The kinetic coefficient of friction between the block A and the inclined plane is 0.35. Determine the acceleration of each block and tension in each cord. 10



Contd. ...

(2)

- (a) Two spheres 1.5 kg and 2.5 kg are connected by a spring of unstretched length of 0.4m with a modulus of 750 N/m, more along a smooth plane. At the instant shown in Fig. 4(a) a force \vec{F} acts on m_2 . Find the acceleration of each mass and the acceleration of the centre of mass. 10

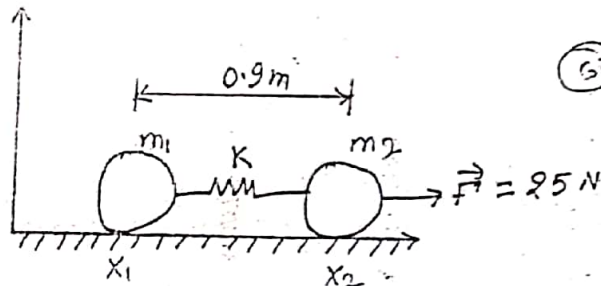


Fig. 4(a)

- (b) Define instantaneous centre of rotation with examples. 6
5. Define d Alembert's principle for plane motion of a rigid body and illustrate its application. 6
- (b) A 30 gm bullet B is fired with a horizontal velocity of 400 m/sec into the side of 15 kg square panel suspended from a hinge at A knowing that the panel is initially at rest, determine: 10
- the angular velocity of the panel immediately after the bullet becomes embedded.
 - the impulsive reaction at A, assuming that the bullet becomes embedded in 0.0007 sec.

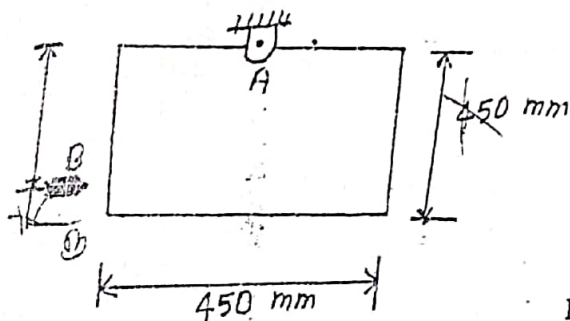


Fig. 5(b)

Contd. ...

(3)

- 6(a) What do you mean by 'Coriolis Acceleration'? Obtain the expression containing 'Coriolis Acceleration'. 6
- (b) A 50 kg block moves between the vertical guides as shown in Fig. 6(b). The block is pulled 45mm down from the equilibrium position and released for each spring arrangement, determine the period of vibration, the maximum velocity of the block and the maximum acceleration of the block. 10

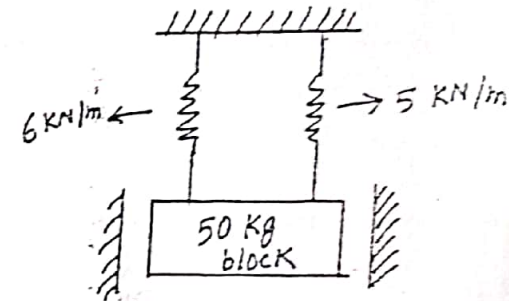


Fig. 6(b)

- 7(a) What do you mean by the free vibration of rigid body? How can you obtain the effective length of vibration plate (i.e. rigid body)? 6
- (b) The magnitude and direction of the velocity of two identical frictionless balls before they strike each other are as shown in Fig. 7(b). Assume $e=0.90$, determine the magnitude and direction of the velocity of each ball after the impact. 10

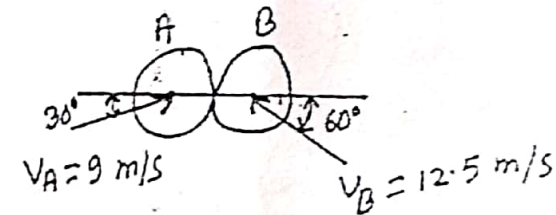


Fig. 7(b)