

PURBANCHAL UNIVERSITY
2023

B. E. Civil/Second Semester/Final

Time: 03:00 hrs.

Full Marks: 60 /Pass Marks: 24

BCI2005: Building Technology (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.

Group A

Very short question any FOUR:

4×2=8

1. What is damp proof course?
2. Mention different types of non-load bearing partitions
3. Describe the general principles of electric services.
4. Why are joints provided in buildings?
5. What is plaster? Write the advantage of plaster.
6. State different types of ventilation.

Group B

Short question:

7×4=28

7. What is a suspended ceiling? Explain the types and functions of suspended ceilings. 4

OR,

- Write about different types of cladding and their functions. 4
8. Explain different types of construction joints with neat sketches. 4
 9. What are cracks? Explain the remedial measures of cracks. 1+3
 10. State the general requirement of staircase and show different elements of staircases. 2+2

OR,

What is Underpinning? How do you provide the formwork for excavations? 1+3

11. Illustrate a detailed sketch of a general door and explain the parts. 4
12. What are the safety measures to be taken while working with electrical services? 4

Contd. ...

(2)

13. What are common problems in existing foundations? Explain the ways to seal cracks in basements. 4

Group C

3×8=24

Long question:

14. Why black cotton soil is considered bad for construction purposes? Explain various types of shallow foundation with neat sketches and their specific purposes. 2+6

OR,

- What is thermal insulation? Explain about the various types of moisture movement in building components. 3+5
15. Explain about single, double, triple roofs. Differentiate between the king post and queen post truss. 3+5

OR,

What is shoring and when is it used? Explain various types of shoring with sketches. 1+1+6

16. Design a staircase for an office building in a room measuring 3m×6m clear. Vertical distance between the floors is 3.6m. Assume the width of flight to be 1.25m. Assume any necessary data. Illustrate the details in plan and cross section. 8

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

Time: 03:00 hrs.

Full Marks: 60 /Pass Marks: 24

BSH2004: Physics (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.

Attempt ALL questions:

Group A

4×2=8

1. Write down the postulates of special theory of relativity.
2. Show that for parallel plate capacitor the displacement current can be written as $I_d = C \frac{dv}{dt}$.

OR,
What are polar and non polar dielectrics?

3. A 20 cm long tube containing 18 percent sugar solution produces optical rotation of 15 degree. Find the specific rotation of sugar.
4. The de - Broglie wavelength associated with an electron is $1\text{\AA}$. Find the potential difference by which the electron associated.

Group B

7×4=28

5. A rod 1 m long is moving along its length with a velocity of 0.6 c. Calculate its length as it appears to an observer.
(a) On the earth
(b) Moving with the rod itself
(c) Calculate the percentage of contraction
6. A solenoid has an inductance of 50 Henry and a resistance of 30 ohm. If it is connected to a 100 V battery, how long will it take for the current to reach one half of its final equilibrium value?
7. Two thin convex lenses having focal lengths 5cm and 2cm are co-axially separated by a distance of 3cm. Find the equivalent focal length and the position of principle points and show in diagram.

Contd. ...

(2)

OR,

Light of wave length $6000\text{\AA}$ is incident normally on a plane transmission grating, find the difference in the angle of deviation in second and third order spectra. The no. of lines per cm on the grating surface is 5000.

8. A ball of mass 500 gm is confined between two impenetrable walls of a stadium that can be modelled as a box of length 100m. Calculate the minimum speed of the ball.
9. Find the drift velocity of free electrons in a copper wire of cross-sectional area 10mm^2 , when the wire carries a current of 100A. Density of copper is 8969 kg/m^3 , its molar mass is 63.5 gm and Avogadro's no. is 6.02×10^{23} per mol.
10. What is an acoustic grating? Explain how an acoustic grating is used to determine the velocity of ultrasonic waves in liquids.
11. How non-destructive tests can detect flaws using electrical methods? Give the various methods in support to your answer.

Or,

Mention few applications of optical fibre. Distinguish between single mode and Multimode fibres with suitable diagram.

Group C

3×8=24

12. What is free oscillation? Derive an expression for the time period of a physical pendulum. Show that point of oscillation and the point of suspension are interchangeable.
13. 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.
14. Derive an expression for the electric field due to an electric dipole at a point on the axial line and equatorial line of the dipole and establish the relation between them.

Or,

Write Maxwell's equations in integral form and convert them into differential form.

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B. E. Civil/Second Semester/Final
Time: 1.5 hrs.

Full Marks: 30 /Pass Marks: 12

BME2006: Fundamental of Thermodynamics and Heat Transfer (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.

Attempt ALL questions.

1. Define thermodynamic state, specific volume, cyclic process and universe. 2
2. Define stored energy and transient energy. Derive an expression for displacement work transfer during isochoric process. 1+3
3. Define law of conservation of energy. 2
4. 3.50kg of H_2O is contained in a closed rigid container with an initial pressure and quality of 960KPa and 45% respectively. Heat is added to the system until the container holds only saturated vapour. Sketch the process on P-V and T-V diagram and determine: (a) the volume of container and (b) the final temperature. (Referring to steam table) 5
5. Describe working principle for otto cycle. 4
6. An air standard Diesel Cycle has a compression ratio of 20. At the beginning of the compression process, the temperature is $18^\circ C$ and the pressure is 0.15 MPa. The cut-off ratio for the cycle is 3. Determine: (a) the thermal efficiency and (b) the temperature and pressure at the end of each process of the cycle. Assume suitable data if needed. 5
7. State and explain Fourier's law of heat Conduction. 4
8. A pipe ($k = 19 \text{ W/mK}$) with inner and outer diameter of 2 cm and 4 cm respectively is covered with 3cm layer of insulation ($k=0.200 \text{ W/mK}$). If the inside wall temperature of the pipe is maintained at 600° and outside wall temperature of the insulation is maintained at 100° . Determine heat loss per meter of length. Also calculate pipe insulation interface temperature. 5

Contd. ...

Properties of Saturated water- pressure table

P kPa	T °C	v_f m ³ /kg	v_{fg} m ³ /kg	v_g m ³ /kg	h_f kJ/kg	h_{fg} kJ/kg	h_g kJ/kg
100	99.632	0.001043	1.6933	1.6943	417.51	2257.6	2675.1
1000	179.92	0.001127	0.1933	0.1944	762.88	2014.8	2777.7
2500	223.99	0.001197	0.07875	0.07995	961.97	1840.2	2802.2
2750	229.11	0.001207	0.07151	0.07272	985.85	1817.2	2803.0

Properties of superheated steam

P kPa	T °C	v m ³ /kg	u kJ/kg	h kJ/kg	s kJ/kg.K
400	(143.64)	(0.4625)	(2553.5)	(2738.5)	(6.8961)
	150	0.4708	2564.4	2752.8	6.9300
	200	0.5342	2646.4	2860.1	7.1699
	250	0.5951	2725.6	2963.6	7.3779
	300	0.6548	2804.4	3065.3	7.5654
	350	0.7139	2883.8	3169.4	7.7378
	400	0.7726	2964.3	3273.3	7.8982
	450	0.8311	3046.0	3378.5	8.0489
	500	0.8894	3129.3	3485.0	8.1914

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BCI2004:: Applied Mechanics II (Dynamics) (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.

Group A

Attempt ALL questions.

4×2=8

- 1(a) What is dynamics? 1
- (b) Derive an expression for motion of particle when acceleration is given as a function of velocity. 4

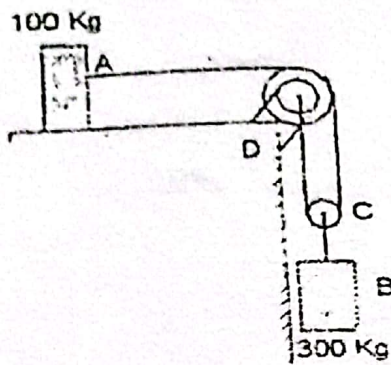
OR,

The motion of a particle is defined by the relation $X = t^2 - 10t + 30$, Where X is expressed in meter and t in second.

Determine:

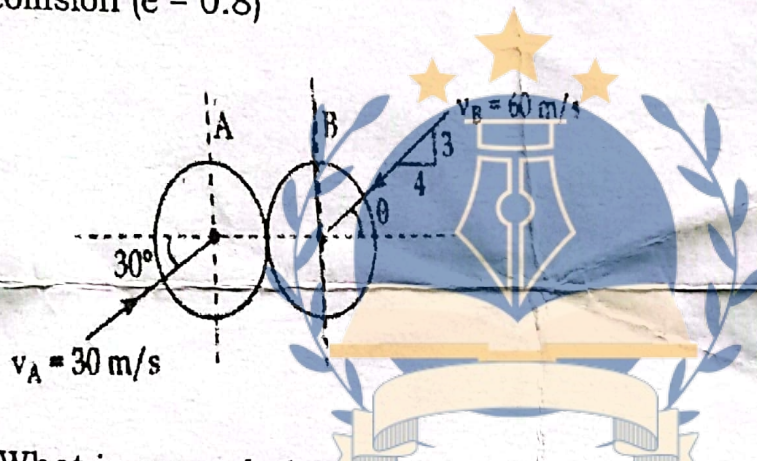
- (i) When the velocity is zero?
- (ii) The position and the total distance travelled when $t = 10$ sec. 4
- (c) The motion of particle is defined by position vector $\vec{r} = 3t^2\hat{i} + 4t^3\hat{j} + 5t^4\hat{k}$ where r is in meter and t is in second. At the instant of 4 sec, find the tangential and normal component of acceleration and also radius of curvature. 5
- 2(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. 4
- (b) The two blocks of mass 100 Kg and 300 Kg shown in figure start from rest. The Pulley are frictionless and the pulley is assumed to be of negligible mass. Assuming the kinetic friction coefficient between block and plane as 0.15. Determine the acceleration of each block and the tension in each cord. 6

Contd. ...



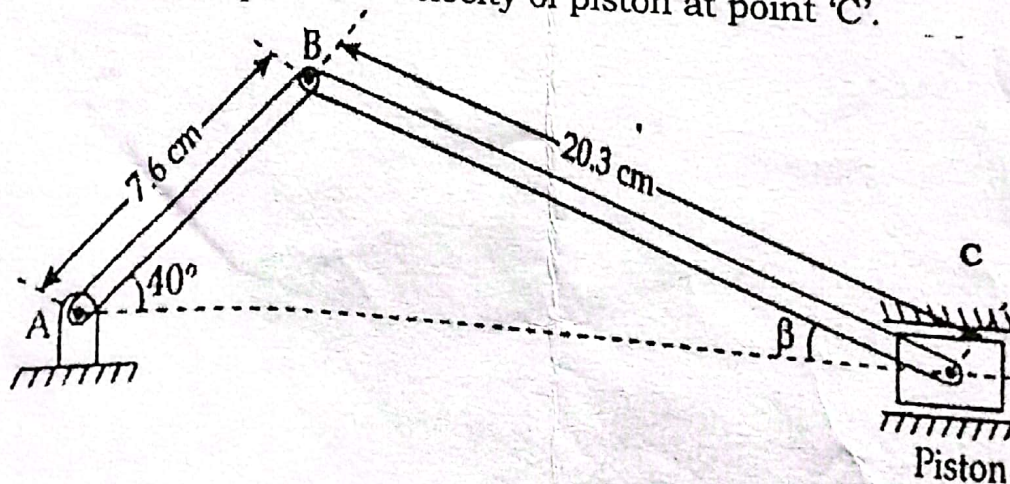
3(a) What do you mean by principle of impulse and momentum for a system of particle? Derive the relation between impulse and momentum. 3

(b) The initial velocities of two balls are 30 m/s and 60 m/s before collision as shown in figure. Determine the magnitude and direction of the velocity of two identical balls ($M_A = M_B$) after collision ($e = 0.8$) 7



4(a) What is general plane motion? Give suitable example. 2

(b) In an engine system as shown in figure a crank AB has a constant clockwise angular velocity of 100 rpm . For the position as indicated in figure, determine the angular velocity of connecting rod BC and velocity of piston at point 'C'. 6



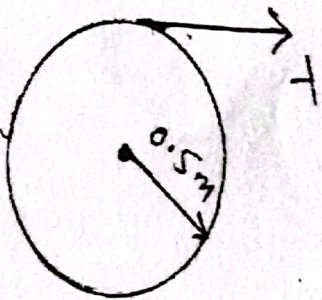
Contd. ...

(3)

5(a) State and explain D' Alembert's principle for plane motion of rigid body. 2

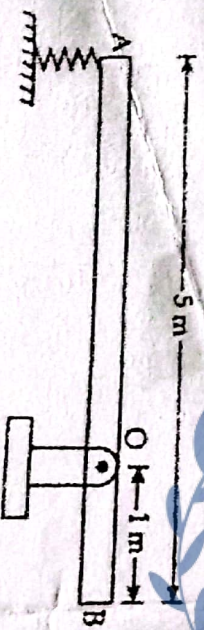
(b) A cord is wrapped around a homogenous disk of mass 15 kg. The cord is pulled upward with a force $T = 180$ N. Determine. 6

- (i) The acceleration of center of disk
- (ii) The angular acceleration of the disk.



6(a) What do you mean by conservative and non-conservative system of forces? 2

(b) A 10 kg slender rod AB as shown is pivoted at O. The other end is pressed against a spring of constant $k = 100$ kN/m in the spring is compressed 50 mm. The rod is in horizontal position. If the rod is released from this position, determine its angular velocity as it passes through vertical position. 6



7. Derive an expression to find response of undamped forced vibration system. 6

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BSH2005: Mathematics-II (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.

Group A

10×2=20

Attempt ALL questions.

1. Find the spherical co-ordinate of the point having Cartesian co-ordinate (1, 0, 1).
2. Find the equation of the line passing through the point (1, 2, 3) and perpendicular to the plane $x - 2y + z = 0$.
3. Find the length of the curve: $x = a \sin t - 1, y = a \cos t + 1, 0 \leq t \leq 2\pi$.
4. Test the convergence of the series:
$$3 + \frac{3}{4} + \frac{3}{4^2} + \dots + \frac{3}{4^{n-1}} + \dots$$
5. Test the convergence of the series $\sum n e^n$ by using integral test.
6. Prove that the vector $r\vec{r}$ is irrotational where $r = |\vec{r}|$ and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$.
7. Solve: $x \frac{dy}{dx} = y + x \sin \frac{y}{x}$.
8. Solve: $(e^y + 1) \cos x \, dx + e^y \sin x \, dy = 0$.
9. Find particular integral of $(D^2 + 4)y = \sin 2x$.
10. Solve: $P^2 + Px + Py + xy = 0$,

Group B

Attempt ALL questions.

10×4=40

11. The plane $x - y - z = 2$ is rotated through 90° about its line of intersection with the plane $x + 2y + z = 2$. Find the equation of the plane in its new position.

Contd. ...

(2)

12. Find the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$. Also find the equation of the shortest distance.
13. Find the equation of sphere that touches the sphere $x^2 + y^2 + z^2 + 2x - 6y + 1 = 0$ at the point $(1, 2, -2)$ and passes through the point $(1, -1, 0)$

OR,

- ✓ Find the equation of cone whose vertex is (p, q, r) and the base $z^2 = 4ay, x = 0$.
- ✓ 14. Find the eccentricity, directrix and identify the conic $r = \frac{6}{2 + 3\sin\theta}$, and hence, sketch it.

OR,

Determine the surface area of the solid generated when the curve: $r^2 = 4\cos 2\theta$ revolves about polar axis.

15. Find the interval of convergence of the power series $\sum \frac{(x-2)^n}{n(n+1)}$. Also indicate its center and radius.
16. Prove that the necessary and sufficient condition for a vector function $\vec{a}$ of scalar variable t to have constant direction is that:
- $$\vec{r} \times \frac{d\vec{r}}{dt} = 0.$$
17. Find the angle between normal to the surface $\phi = xy - z^2$ at the point $(1, 4, 2)$ and $(-3, -3, 3)$.

OR,

If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $\vec{a}$ is a constant vector, prove that

$$\nabla \times \left(\frac{\vec{a} \times \vec{r}}{r^3} \right) = -\frac{\vec{a}}{r^3} + \frac{3(\vec{a} \cdot \vec{r})}{r^5} \vec{r}$$

Contd. ...

(2)

18. Solve: $(2x + y - 3)dx + (x + 3y - 2)dy = 0$

OR,

Find the axis, the vertex, latus rectum and focus of the parabola
 $16x^2 - 24xy + 9y^2 - 104x - 172y + 44 = 0$.

✓ 19. Solve; $(D^2 - 4D + 3)y = e^x \cos 2x$

20. Find the series solution of differential equation $y'' - 2y = 0$.

OR,

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



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