3004

B. Tech. (Civil Engg.) 1st Semester Examination – December, 2022

MECHANICS

Paper : BSC-PHY-104-G

Time : Three Hours]　　　　　　[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting at least *one* from each Unit. Question No. **1** is *compulsory*. All questions carry equal marks.

1. (a) What do you mean by a constraint motion in mechanics ?　　　　　　$5 \times 3 = 15$

   (b) Write down necessary and sufficient conditions of rigid body equilibrium for coplanar nonconcurrent force system in two dimensions.

   (c) A solid sphere and a hollow sphere have the same mass and radius. Will they have the same moment of inertia about their principle axes ? Explain.

   (d) What is the main difference between periodic and harmonic motion ?

(e) Find out if the force field $F(x, y) = yzi + zxj + xyk$ is conservative or not. (where i, j and k are unit vectors along x, y and z-axis, respectively).

UNIT – I

2. (a) A 50 kg block is on an inclined plane of 30° and attached with a mass m by an inextensible string over a frictionless pulley(P), as shown in fig. given below. The coefficient of static friction between the block and the plane is 0.3, what is the range of m under which the block is resting ?   **8**
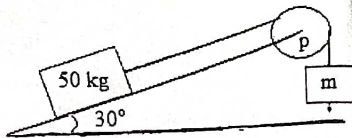
(b) Show that Newton's second law is invariant in inertial frames.   **7**

3. State and explain Newton's laws and derive the differential equation of motion in polar coordinate.   **15**

UNIT – II

4. What do you understand by damped harmonic oscillations ? Derive its differential equation of motion and hence explain the term lightly damped, over damped and critically damped oscillations.   **15**

5. Derive the five-term acceleration formula for the rotating coordinate system and explain the fictitious forces.   **15**

UNIT – III

6. What do you understand by a rigid body ? Derive Euler's equation for rigid body motion.   **15**

7. (a) State and prove the perpendicular axis theorem for a moment of inertia for a plane lamina.   **8**

(b) Briefly explains the kinetic energy of a rotating rigid body.   **7**

UNIT – IV

8. (a) Define trusses and explain perfect and non-perfect trusses. What are the main assumptions in truss analysis ?   **5**

(b) Analyse the given truss of BC = (BD+DC) = 5m + 2.5 m spans, loaded at D as shown in the fig. below. Find the magnitude and nature of the force in all members.   **10**
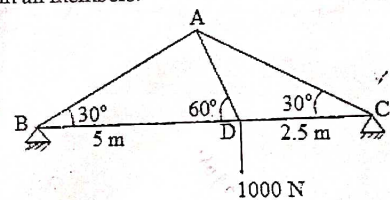
**9.** (a) Explain the limiting and non-limiting friction with an example.

5

(b) In the fig. given below, find the frictional force and acceleration of the blocks A & B. If the force(F) apply along the horizontal direction is given by : .

10

(i) F = 100 N

(ii) F = 300 N

(iii) F = 500 N

It is given that the value of the coefficient of friction (static/dynamic) is 0.5 in between the blocks and 0.4 in between block A and ground.
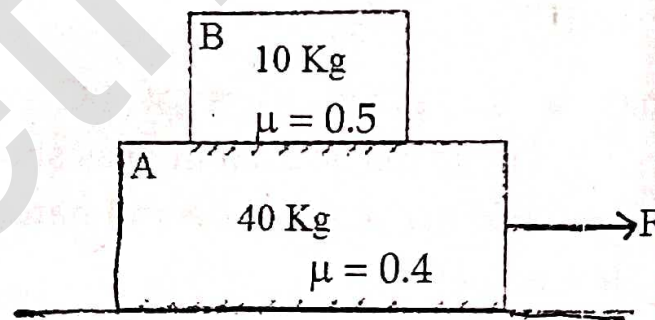
3010

B. Tech. 1st Semester (Common for All Branches) Examination – December, 2022

BASIC ELECTRICAL ENGINEERING

Paper : ESC-EE-101-G

Time : Three hours]   [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, by selecting *one* question from each Section. Question No. 1 is *compulsory*.

1. (a) State and explain Faradays law of electro magmatic induction. $5 \times 3 = 15$

   (b) Define Average Value, if the standard value of current is $i = I_m \sin \omega t$, what will be the rms value ?

   (c) Write down assumptions for an ideal transformer.

   (d) What do you mean by back EMF, give expression ?
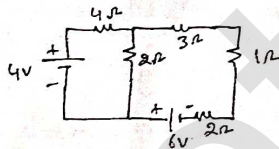
(e) Briefly write down about attraction type MI instruments.

SECTION – A

2. (a) State and explain Norton's Theorem.   7

   (b) In the given circuit, find the current through 2 ohm resistor using Superposition Theorem.   8
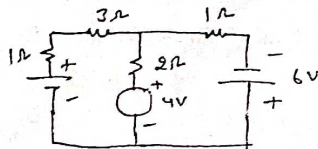
3. State Thevenin's Theorem. Determine the value of current flowing through 1 ohm resistance by using Thevenin's theorem.   15


SECTION – B

4. (a) The maximum value of alternating voltage and current are 420V and 22A respectively in a circuit connected to 50Hz supply and these quantities are sinusoidal. The instantaneous values of the voltage and current are 280V and 10A respectively at t = 0 both increasing positively.   10

(i) Write down the expression for voltage and current at time t.

(ii) Determine the power consumed in the circuit.

(b) Define RMS value of a sinusoidal signal and hence deduce Form Factor.   5

5. (a) An alternating current of frequency 50Hz has a maximum value of 115A. Write down the equation for its instantaneous value. Reckoning time from the instant the current is zero and becomes positive; find (a) the instantaneous value after 1/360 sec and (b) the time taken to reach 96A for the first time.   8

   (b) Define real power, reactive power and apparent power. Also explain the mathematical equation for all these three terms.   7

SECTION – C

6. (a) Using appropriate phasor diagram, derive the relationship among voltages and current in star connection in three phase system.   8

   (b) A balanced star-connected load of (8+j6) ohms per phase is connected to a balanced 3-phase 420V supply. Find the line current, power factor and total volt-amperes.   7
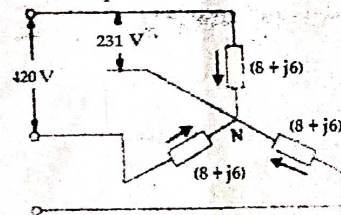
7. (a) Using the appropriate phasor diagram, derive the relationship among voltages and currents in delta connected three phase system. 8

(b) A delta connected balanced 3 phase load is supplied from a 3 phase, 420V supply. The line current is 22A and the power taken by the load is 10,500W. Find (i) impedance in each branch (ii) the line current, power factor and power consumed if the same load is connected in star. 7

SECTION – D

8. Briefly explain construction, working and principle of Induction machine with neat labelled diagrams. 15

9. A separately excited DC generator has armature circuit resistance of 0.2 ohm and the total brush drop is 1 V per brush. When running at 960 rpm, it delivers a current of 110A at 260V to a load of constant resistance. If the generator speed drop to 680 r.p.m, with field-current unaltered, find the current delivered to the load. 15

B. Tech. 1st Semester (ME)
Examination – December, 2022

MATHEMATICS - I (Calculus and Matrices)

Paper : BSC-MATH-101-G

Time : Three Hours]   *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. **1** is *compulsory*. All questions carry equal marks.

1. (a) Evaluate : $\beta(2.5, 1.5) = ?$

   (b) Evaluate the integral : $\int_0^1 \int_0^{x^2} \frac{3}{2} \, e \, dy \, dx$.

   (c) Test the convergence of series :

$$\sqrt{\frac{1}{4}} + \sqrt{\frac{2}{6}} + \sqrt{\frac{3}{8}} + \sqrt{\frac{4}{10}} + \ldots \ldots \infty$$

   (d) If $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then find $\operatorname{div} \bar{r} = ?$

(e) Find the rank of matrix : $\begin{bmatrix} 1 & 2 & 3 & 4 \\ -2 & 0 & 5 & 7 \end{bmatrix}$.

(f) Using Cayley-Hamilton theorem find A^8 where

$A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$. $2.5 \times 6 = 15$

UNIT – I

2. (a) Examine the function :

$$f(x,y) = x^3 + y^3 - 63(x+y) + 12xy$$

for maxima and minima.   7.5

(b) For every value of x, show that :   7.5

$$\sin x = x - \frac{x^3}{\underline{|3}} + \frac{x^5}{\underline{|5}} + \dots + (-1)^{n-1} \frac{x^{2n-1}}{\underline{|2n-1}} + (-1)^n \frac{x^{2n}}{\underline{|2n}} \sin\theta x$$

where $0 < \theta < 1$

3. (a) Find the volume of solid formed by the revolution about the x-axis of the loop of the curve :   7.5

$$y^2 = \frac{x^2(a+x)}{(a-x)}$$

(b) State and prove relation between β-γ functions.   7.5

UNIT – II

4. Test the convergence of the series :   7.5 + 7.5 = 15

(a) $1 + \dfrac{1}{2} + \dfrac{x^2}{3\sqrt{2}} + \dfrac{x^4}{4\sqrt{3}} + \dfrac{x^6}{5\sqrt{4}} + \dots\infty,\ x > 0$

(b) $1 + x + \dfrac{1}{2}\dfrac{x^3}{3} + \dfrac{1.3}{2.4}\dfrac{x^5}{5} + \dfrac{1.3.5}{2.4.6}\dfrac{x^7}{7} + \dots\infty,\ x > 0$

5. (a) Expand $\sin z$ as a Taylor series about $z = \dfrac{\pi}{4}$.   7.5

(b) If $f(x) = \begin{cases} x & \text{for} \quad 0 < x < \dfrac{\pi}{2} \\ \pi - x & \text{for} \quad \dfrac{\pi}{2} < x < \pi \end{cases}$, then show that

$$f(x) = \frac{\pi}{4} - \frac{2}{\pi}\left[\frac{\cos 2x}{1^2} + \frac{\cos 6x}{3^2} + \frac{\cos 10x}{5^2} + \dots \right]$$ 7.5

UNIT – III

6. (a) Discuss the continuity for :

$$f(x,y) = \begin{cases} \dfrac{xy}{\sqrt{x^2+y^2}} & ;\ (x,y) \neq (0,0) \\ 0 & ;\ (x,y) = (0,0) \end{cases}$$

at the point $(0, 0)$.   7.5

(b) If $u = x^y + y^x$ then using that $\dfrac{\partial^2 u}{\partial x\,\partial y} = \dfrac{\partial^2 u}{\partial y\,\partial x}$.   7.5

7. (a) Examine for extreme values of :   7.5

$$f(x,y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2.$$

(b) Find curl $(\text{curl } \bar{v})$, where $\bar{v} = (2xz^2)\hat{i} - yz\hat{j} + 3xz^3\hat{k}$

at $(1, 1, 1)$.   7.5

8. (a) For what value of p and q, the following system of equations : 7.5

$x + y + z = 6,\ x + 2y + pz = q,\ x + 2y + 3z = 10$ have :

(i) no solution

(ii) unique solution

(iii) many solutions

(b) Prove that inverse and transpose of an orthogonal matrix are orthogonal. 7.5

9. Find the Eigen values and Eigen vectors of the matrix : 15

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}.$$

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B. Tech. 1st Semester (Common for All Branches) Examination – December, 2022

ENGLISH

Paper : HSMC-ENG-101-G

Time : Three Hours]   [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Answer the following questions briefly :   2.5 × 6 = 15

    (a) What is the central theme of 'The Secret of Work' ?

    (b) What is Intellectual Rubbish ?

    (c) Differentiate between 'Course' and 'Coarse' by using in sentence.

(d) Make words using the prefixes -inter, -extra, -in, -im, ambi

(e) Describe a Scientific Calculator.

(f) What are Diphthongs ?

UNIT – I

2. (a) Make sentences based on following verb patterns : 5 × 3 = 15

    (i) Sub+Verb+Gerundican Infinitive

    (ii) Sub+Verb+Noun Complement

    (iii) Noun Phrase+Verb+Direct Object

    (iv) Subjet+Verb+Subject Complement

    (v) To Infinitive+Verb+Noun

(b) Correct the following sentences :

    (i) I live in Delhi since 2004

    (ii) I have received your letter yesterday

    (iii) The doctor saw my pulse

    (iv) I begged him a favour

    (v) I am looking forward to hear from you

(c) Do as directed :

    (i) He died .... cholera.

                      (insert preposition)

    (ii) He is fool, He is knave.

                      (make compound)

    (iii) Honesty is .... best policy.

                      (insert article)

    (iv) Three and three .... four.

                    (insert correct verb form)

    (v) I, you and he will go. (re-arrange pronouns)

3. Use the following pairs in your sentences so as to make the meanings of the individual words clear :

                      3 × 5 = 15

    (i) Lately, Late

    (ii) Serial, Cereal

    (iii) Currant, Current

    (iv) Lather, Leather

    (v) Dessert, Desert

UNIT – II

4. (a) Supply One-word Substitutes : 7.5 × 2 = 15

   (i) After death

   (ii) Absence of law and order

   (iii) Fear of books

   (iv) Absence of government

   (v) The study of birds

   (b) Supply meanings of the following foreign words and make sentences :

   (i) Ad infinitum

   (ii) Alma-mater

   (iii) Bon Voyage

   (iv) Honorarium

   (v) Ex-gratia

5. (a) Make sentences with the following idioms :

   7.5 × 2 = 15

   (i) Dark horse,

   (ii) Break the ice,

   (iii) Run into

   (iv) Turn down

   (v) Watch out

   (b) Change into passive voice :

   (i) He has finished editing his copy.

   (ii) Sit down please.

   (iii) Who has asked you for chocolate ?

   (iv) They have thrown it.

   (v) The government has passed a legislation.

UNIT – III

6. Write short notes on any *two* : 7.5 × 2 = 15

   (a) Respiratory system

   (b) Nansal Consonants

   (c) Articulatory Organs

OR

Draw a neat diagram of Speech Mechanism and mark all speech organs.

7. Define Monophthongs. Why are they called pure vowels ? List all Monophthongs ?   15

UNIT – IV

8. Record your impression of Bertrand Russell's essay *An Outline of Intellectual Rubbish*   15 × 1 = 15

OR

Describe *a typical day of a sister of charity* commenting on the four vows taken by the Missionaries.

9. Write an essay on Swami Vivekanand's idea of "Working like a master, not like slave".   15 × 1 = 15

OR

Draft an application to the Vice Chancellor of your university and request for review of your curriculum by academic council and upgrade the same in line with industry demands.