

Jharkhand University of Technology, Ranchi

B.Tech. 1st Semester Examination, 2023 (NEP)

Subject : Basics of Electrical Engineering

Subject Code : ESEE1

Time Allowed : 3 Hours

Full Marks : 70

Answer in your own words.

Candidates are required to give the answers of five questions in which Question No. 1 is compulsory and answer any four from the rest questions.

All questions carry equal marks.

1. Answer the following:

$2 \times 7 = 14$

- (i) If single phasing occurs when the motor is running, it should not be loaded beyond
(a) 10 per cent of the rated load. (b) 30 per cent of the rated load.
(c) 50 per cent of the rated load. ~~(d) 75 per cent of the rated load.~~
- (ii) The wattage rating for a Ceiling fan motor will be in the range of
(a) 15 to 30 W ~~(b) 50 to 150 W~~ (1)
(c) 200 to 250 W (d) 250 to 500 W
- (iii) The starting winding of a single phase motor is placed in
~~(a) Armature~~ (b) Field
(c) Rotor ~~(d) Stator~~
- (iv) The Norton's equivalent is the _____ generator model of a network.
(a) Voltage ~~(b) Current~~
(c) Power (d) None of these
- (v) Which among the following may not be considered as a rating of circuit Breaker?
~~(a) Rated current and voltage~~ (b) Rated Frequency
(c) Rated Insulation level ~~(d) Rated power~~ (245)
- (vi) The losses in a DC cable are less than those with AC cable because
(a) there is no skin effect (b) dielectric loss is small
(c) sheath losses is small ~~(d) All of these~~

(2)

EEI

- (vii) The circuit shown in fig.1. Find the Thevenin's voltage across the Terminals A and B.

5. (2)

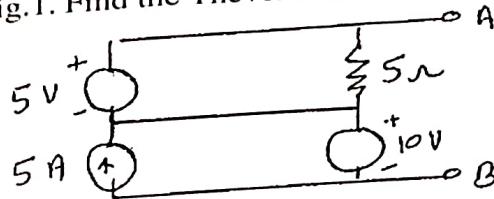


Fig. 1

$$R_{th} = 5\Omega$$

$$\begin{aligned} V_{th} &= IR \\ &= 5 \times 5 \\ &= 25 \end{aligned}$$

- (a) 5V
(c) 15V

- (b) 10V
(d) 20V

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

~~5~~

- (b) Using Thevenin's Theorem, find the current through 10Ω Resistance for the circuit shown in fig.2.

7+7

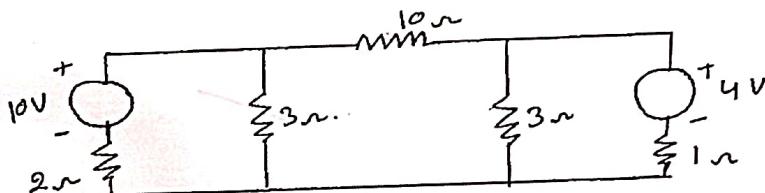


Fig. 2

3. (a) State Theorem and derive the condition for Maximum power transfer.

- (b) Compute the current through 23Ω resistance for the circuit shown in fig.3 using Superposition theorem.

7+7

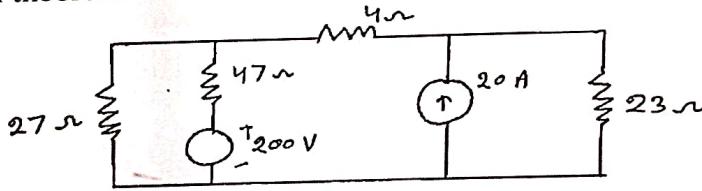


Fig. 3

2
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4. (a) Describe with diagram how alternating voltages are generated.

- (b) Find the average value of the wave shown in the fig. 4.

7+7

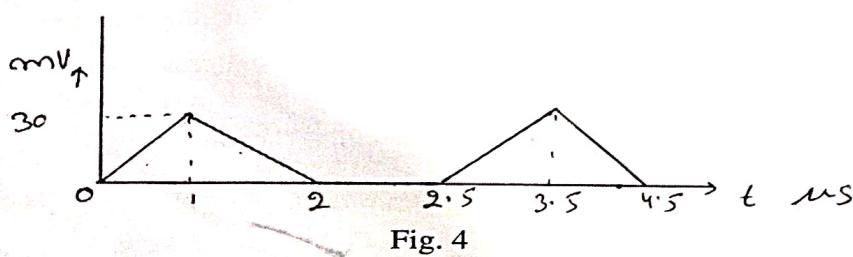


Fig. 4

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(3)

EEI

- B.
S. 5. (a) A single phase transformer supplies a load of 20kVA at a power factor of 0.81 lagging. The iron loss of the transformer is 200W and the copper loss at this load is 180W. Calculate-

- (i) The efficiency
(ii) If the load is now changed to 30kVA at a power factor of 0.91 lagging, calculate the new efficiency.

(b) Describe the working principle of a transformer. S

7+7

6. (a) Explain the main parts of the DC machine. G

- (b) A 8 pole, 400V DC shunt motor has 960 wave connected armature conductors. The full load armature current is 40A and the flux per pole is 0.02Wb. The armature resistance is 0.01Ω and the contact drop is 1V per brush. Calculate the full load speed of the motor. 7+7

$3.5 \times 4 = 14$

7. Write short notes on any four:

- (a) Properties of fuses 2
(b) Miniature circuit breaker (MCB) 2
(c) Importance of earthing 3 S
(d) Star-Delta Transformation
(e) Slip and its application

$$\frac{f_1}{V_1} = \frac{f_2}{V_2}$$

Jharkhand University of Technology, Ranchi
B.Tech. 1st Semester Examination, 2023 (NEP)

Subject : Engineering Mechanics

Time Allowed : 3 Hours

Subject Code : ESEM1

Full Marks : 70

*Candidates are required to give the answers in their own words as far as practicable.
Answer any five Questions in which Question No.1 is compulsory.
All questions are of equal value.*

1. Choose the correct alternative:

$2 \times 7 = 14$

- (i) What is the dot product of two vectors which are having a magnitude equal to unity and are making an angle of 45° ?
- (a) - 0.707 (b) 0.707
(c) - 1.414 (d) 1.414
- (ii) The moment is the cross product of which two vectors?
- (a) Radius and Force vectors (b) Force and Radius vectors
(c) Radius and Force scalars (d) Force and Radius scalars
- (iii) The possible loading in various members of framed structures are
- (a) compression or tension (b) buckling or shear
(c) shear or tension (d) all of these
- (iv) Frictional force encountered after commencement of motion is called
- (a) Limiting friction (b) Kinematic friction
(c) Frictional resistance (d) Dynamic friction
- (v) The radial component of velocity for a particle moving in circular path is _____.
(a) constant (b) radius itself
(c) variable (d) zero
- (vi) A bus travels with a speed of 15 m/s when accelerated at 0.10 m/s^2 from its rest position. What is the distance travelled?
(a) 1000 m (b) 1125 m
(c) 2250 m (d) None of these

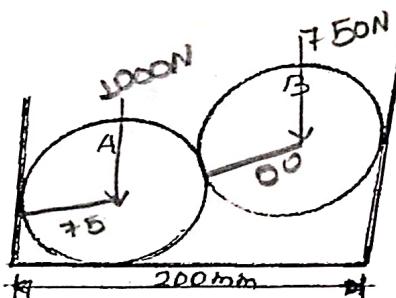
(vii) An object is released from a certain height above the ground. Just at time it touches ground it will possess _____.

- (a) Potential energy
 (c) Heat energy

- (b) Kinetic energy
 (d) Chemical energy

2. (a) Explain moment of a force and moment of couple.

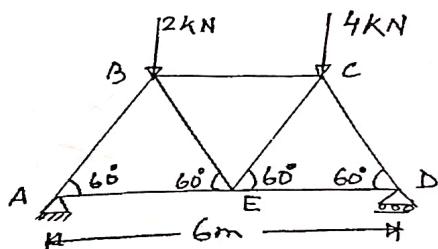
(b) Two spheres A and B of weight 1000 N and 750 N respectively are kept as shown in fig. Determine the reactions at all contact points. Radius of A is 75 mm and radius of B is 50 mm.



3. (a) What are the assumptions in analysis for plane truss?

(b) Find the forces in all the members of the truss shown below.

4+10



$$\begin{aligned} R_A + R_D &= 0 \\ \sum M_A &= 0 \\ R_D \times 6 &= 4 \times 3 + 2 \times 3 \\ R_D &= 32 \div 6 \\ 6P_D &= 18 \\ P_D &= 3 \end{aligned}$$

4. (a) Define coefficient of friction and limiting friction.

(b) A uniform ladder of 4 m length rests against a vertical wall with which it makes an angle of 45°. The coefficient of friction between ladder and wall is 0.4 and that between ladder and the floor is 0.5. If a man, whose weight is one-half of the ladder ascends it, how high will it be when the ladder slips?

4+10

5. (a) Derive the tangential and normal components of velocity and acceleration for a moving particle.

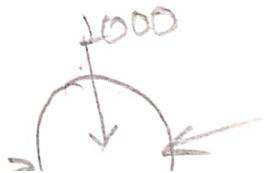
(b) The acceleration of a particle is given by $a = t^3 - 3t^2 + 5$, where a is in m/s^2 and t is in second. At $t = 1 \text{ s}$, the displacement and velocity are 8.5 m and 6.25 m/s respectively. Calculate the displacement and velocity at $t = 2 \text{ sec}$.

7+7

EMI

(3)

- (a) Explain work, energy and power.
- (b) A hammer of mass 0.5 kg hits a nail of 25 g with a velocity of 5 m/s and drives it into a fixed wooden block by 25 mm. Find the resistance offered by the block. 6+8
7x2
7. Write short notes on *any two* of the following:
- (a) Belt friction
 - (b) Impulse momentum principle
 - (c) Equivalent system of forces



Jharkhand University of Technology, Ranchi

B.Tech. 1st Semester Examination, 2023 (NEP)

Subject : Indian Knowledge System

Subject Code : HSM01

Time Allowed : 3 Hours

Full Marks : 70

Answer any five out of the seven questions as provided hereinunder.

*Question No. 1 is compulsory. Try to write clearly in your own language as far as possible.
Each question carries equal weightage of Marks.*

1×14

1. Answer the following questions as directed:

- (i) Nalanda and _____ were the two important ancient centres of learning in the Indian subcontinent. (Fill in the blank)
- (ii) Kautilya was also known as Vishnugupta. (State True or False)
- (iii) The last and eighth element of Yoga Sutras practice is known as _____. (Fill in the blank)
- (iv) Vagbhata was the author of two great treatises of Ayurveda, namely _____ and _____. (Fill in the blank)
- (v) Who was the father of Vagbhata?
- (vi) The material used for Gandhara sculptures were _____ and _____. (Fill in the blanks)
- (vii) The Jantar Mantar in Jaipur was built by the Maharaja Hari Singh of Jaipur. (State True or False)
- (viii) _____ in 800 BCE calculated the value of 'pi'. (Fill in the blank)
- (ix) The first gold coins in India were minted by Kushana King _____. (Fill in the blank)
- (x) Brihadisvara Temple is located in _____. (Fill in the blank)
- (xi) It is said that in Ancient India, _____ Maharshi invented an Electric-Cell made of an Earthen Pot. (Fill in the blank)
- (xii) The Indus Valley Civilisation used _____ rules prior to 1500 BCE. (Fill in the blank)
- (xiii) Sanchi Stupa was commissioned by _____ in 3rd century BC. (Fill in the blank)
- (xiv) The binary number system was first described by the Vedic scholar _____. (Fill in the blanks)

Please Turn Over

M01

(2)

2. "We owe a lot to the ancient Indians, teaching us how to count. Without which most modern scientific discoveries would have been impossible." Whose statement is this and how does this statement justify the rich 'Indian Knowledge System' contributing immensely to the world? 14
3. Elucidate in detail the importance of Vaghbhata in the field of Ayurveda. How do you see Ayurveda as an alternate system of medicine and do you think that it is posing a great deal of challenge to other branches of modern medicine? 14
4. What do you mean by the term 'Sustainable Environment'? Explain the term in the light of new challenges of Global Warming and depleting natural resources that have posed a great threat to the very survival and existence of Human Beings. 14
5. What are the different Schools of Art that had flourished in Ancient India? Explain in detail the period, main features of these Schools of Art and the places of their origins. 14
6. Sir Isaac Newton is credited for giving us the concept of 'Law of Gravity'. Do you think the 'Law of Gravity' has got any ancient India connection? If yes, explain how and why. 14
7. Write short notes on:
(a) Vedic Mathematics
(b) Minting and Casting of Metals in Ancient India
(c) Agriculture in Ancient India
(d) Aryabhatta

$3.5 \times 4 = 14$

Jharkhand University of Technology, Ranchi

B.Tech. 1st Semester Examination, 2023 (NEP)

Subject : Programming for Problem Solving

Subject Code : ESPP1

Time Allowed : 3 Hours

Full Marks : 70

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

Question No. 1 is compulsory and answer any four questions from the rest.
The figures in the right-hand margin indicate full marks.

~~2x7=14~~

1. Choose the correct answer:

(i) How is an array initialized in C language?

- (a) ~~int a[3] = {1, 2, 3};~~
(c) int a[] = new int [3]

- (b) int a = {1, 2, 3};
(d) int a[3] = [1, 2, 3];

35

(ii) How is the 3rd element in an array accessed based on pointer notation?

- (a) * a+3
(c) * (*a+3)

- (b) * (a+3)
(d) \$ (a+3)

30

(iii) How are strings represented in memory in C?

- (a) An array of characters
(c) Same as other primitive data type

- (b) The object of some class
(d) Linked list of characters

(iv) What does the following declaration indicate int x : 8;?

- (a) X stores a value of 8
(e) Both (a) and (b)

- (b) X is an 8-bit integer
(d) None of these

(v) Which of the following is the proper syntax for declaring macros in C?

- (a) # define long long ||
(e) # define ||

- (b) # define || long long
(d) # define long long

(vi) Which of the following is an exit controlled loop?

- (a) while loop
(c) do-while loop

- (b) for loop
(d) None of these

(vii) How to declare a double pointer in C?

(a) int * val

~~(c)~~ int, \$ val

(b) int ** val

(d) int *\$ val

2. (a) Write a program to explain bubble sort. Which type of technique does it belong and what is the worst case and best case time complexity of the bubble sort?

(b) Write a C-program for sorting integers in ascending order using insertion sort with the help of example. (6) 7+7

3. (a) Write an algorithm and develop a C program that reads N integer numbers and arrange them in ascending order using selection sort. (2)

(b) Explain structure within a structure with an example. (6) 7+7

4. (a) Write a program in C using functions to swap two numbers using global variables concept and call by reference concept. (6)

(b) What is recursion? Explain. Write a C program using recursive function for Binary to decimal conversion. (6) 7+7

5. (a) Write a program in C to find the sum and mean of all elements in an array using pointers.

(b) Explain different categories of pre-processor directives used in C. 7+7

6. (a) Write a C program using structures to read, write, compute average marks and display the students scoring above and below the average marks for a class of 'N' students.

(b) Evaluate the following expressions:

(i) $22 + 3 < 6 \$ \$! 5 || 22 == 7 \$ \$ 22 - 2 > +5$

(ii) $a + 2 > b || ! c \$ \$ a == d * a - 2 < = e$

where $a = 11$, $b = 6$, $c = 0$, $d = 7$ and $e = 5$. 7+7

7. (a) With a neat diagram explain the basic structure of a computer and also explain the different types of computer. (12)

(b) Explain if, if-else, nested if-else and cascaded if-else with example and syntax.

Jharkhand University of Technology, Ranchi

B.Tech. 1st Semester Examination, 2023 (NEP)

Subject : Engineering Physics

Subject Code : BSP01

Time Allowed : 3 Hours

Full Marks : 70

Pass Marks : 21

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

*Question No. 1 is compulsory and answer any four questions from the rest.
The figures in the right-hand margin indicate full marks.*

1. Choose the correct answer:

$2 \times 7 = 14$

(i) The energy of n th state in a 1-D potential box is

- | | |
|---|--|
| (a) Zero

(c) $\frac{n^2 h^2}{8ma^2}$ | (b) $\frac{2nh^2}{ma^2}$

(d) $\frac{nh}{8ma^2}$ |
|---|--|

(ii) At $T = 0$ K, the energy level located above E_F (when $E > E_F$) are

- | | |
|--|--|
| (a) Partially filled

(c) Filled | (b) Vacant

(d) None of these |
|--|--|

(iii) Fermi-Dirac distribution function is given by

- | | |
|---|---|
| (a) $F(E) = \frac{1}{1+e^{(E-E_F)/KT}}$ | (b) $F(E) = \frac{1}{1-e^{(E-E_F)/KT}}$ |
| (c) $F(E) = 1 - \frac{1}{1+e^{(E-E_F)/KT}}$ | (d) None of these |

(iv) The unit of Hall co-efficient is

- | | |
|---|-------------------------------|
| (a) $\Omega - m^3/Wb$ | (b) $\Omega^{-1} - m^{-3}/Wb$ |
| (c) $\Omega - m^{-3}/Wb$ | (d) $\Omega - m^2/Wb$ |

(v) For a normalized wave function Ψ , the value of $\int_{-\infty}^{\infty} \Psi^* \Psi d\tau$ will be

- | | |
|--------------|--------------|
| (a) 1 | (b) 0 |
| (c) 2 | (d) ∞ |

(vi) If N_1 and N_2 are the number of atoms in ground and excited state, respectively, then in population inversion

~~(a)~~ (b) $N_1 < N_2$

(c) $N_1 = N_2$

(d) $N_1 > N_2$

(e) None of these

(vii) The atomic radius of simple cubic lattice is

(a) $\frac{a}{2}$

(c) $\frac{\sqrt{2}}{4}a$

~~(b)~~ (d) $\frac{\sqrt{3}}{4}a$

(d) $\frac{a}{4}$

2. (a) What is Hall effect? Obtain the expression of Hall coefficient (R_H) for N-type and P-type semiconductor.

(b) How can we determine whether the given semiconductor is N-type or P-type using Hall effect?

7+7

3. (a) Classify the solids on the basis of Band Theory.

~~(b)~~ Discuss Fermi Dirac probability function and obtain an expression for it.

6+8

4. (a) What is wave function? Discuss its physical interpretation.

~~(b)~~ Derive the time dependent and independent Schrödinger's wave equation.

(c) An electron is constrained to a one dimensional box of the side 0.1 nm. Find the first four energy Eigen Values in eV.

5+6+3

5. (a) What do you understand by population inversion and pumping?

~~(b)~~ What do you mean by spontaneous and stimulated emission? Find the relation between Einstein's co-efficient.

~~(c)~~ Explain the construction and working action of solid state laser with proper diagram.

4+(2+4)+4

6. (a) Show that in a cubic lattice the distance between the successive planes of indices is given by

$$d_{hkl} \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

(b) Find the interplanar spacing for the lattice planes of Miller indices (321), (210) and (111) for a cubic lattice with $a = 5.62 \text{ \AA}$.

7+7

7. (a) Explain the following terms:

(i) Rest mass and effective mass of an electron

(ii) Acceptance angle

(iii) Numerical aperture

~~(b)~~ Derive expression for concentration of electrons in conduction band and holes in the valence band in an intrinsic semiconductor.

(2x3)+8

Jharkhand University of Technology, Ranchi**B.Tech. 1st Semester Examination, 2023 (NEP)****Subject : Engineering Mathematics-I****Subject Code : BSM01****Time Allowed : 3 Hours****Full Marks : 70***Candidates are requested to give the answers in their own words as far as practicable.**The figures in the margin indicated full marks.**Answer any five questions. Question No. I is compulsory.***1. Answer the following questions:** **$2 \times 7 = 14$** (i) If $A = PDP^{-1}$ then A^n equals to

- (a) $P^n D (P^{-1})^n$
 (b) $P^n D P^{-1}$
 (c) $PD(P^{-1})^n$
 (d) $PD^n P^{-1}$

(ii) Let V be a vector space of all real numbers R over R . Which of the following is a vector subspace of V ?

- (a) $C(R)$
 (b) $R(R)$
 (c) $Q(R)$
 (d) $Z(R)$

(iii) If $u + v = x$, $uv = y$, then $\frac{\partial(x,y)}{\partial(u,v)}$ is equal to

- (a) $u - v$
 (b) uv
 (c) $u + v$
 (d) None of these

(iv) The necessary condition that the point (a,b) is a _____ point of $f(x,y)$ if $f_x(a,b) = f_y(a,b) = 0$.

- (a) maximum
 (b) stationary
 (c) saddle point
 (d) minimum

(v) The value of $\int_0^\infty e^{-x} x^{\frac{3}{2}} dx$ is

- (a) $\frac{3}{4}\sqrt{\pi}$
 (b) $\frac{5}{4}\sqrt{\pi}$
 (c) $\frac{3}{5}\sqrt{\pi}$
 (d) $\frac{1}{4}\sqrt{\pi}$

(vi) The value of $\int_3^6 \int_2^4 \int_1^2 dx dy dz$ is

- (a) 2
 (b) 4
 (c) 6
 (d) 10

- vii) Let \vec{F} be the force acting on a particle, then $\int_C \vec{F} \cdot d\vec{r}$ represents _____ by the particle.

~~(a)~~ Work done
(c) Conservative field

(b) Circulation (1)
(d) None of these

2. ~~(a)~~ Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 7 & -1 & 3 \\ 6 & 1 & 4 \\ 2 & 4 & 8 \end{bmatrix}$ and hence find its inverse. (6)
- ~~(b)~~ Show that the equations $3x + 4y + 5z = a$; $4x + 5y + 6z = b$; $5x + 6y + 7z = c$ do not have a solution unless $a + c = 2b$. (5) 7+7

3. (a) If $T: R^2 \rightarrow R^3$ is a linear transform defined by $T(x_1, x_2) = (x_1 - x_2, x_2 - x_1, -x_1)$. Find a basis and dimension for $R(T)$ and $N(T)$. Also, verify Rank-Nullity theorem.

(b) If $x^x y^y z^z = c$, then show that at $x = y = z$, $\frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}$. 7+7

4. (a) The temperature T at any point (x, y, z) in space is $T(x, y, z) = kxyz^2$. Find the highest temperature on the surface of the sphere $x^2 + y^2 + z^2 = a^2$.
- (b) If $u = x^2 - 2y^2, v = 2x^2 - y^2$, where $x = r \cos \theta, y = r \sin \theta$, show that $\frac{\partial(u,v)}{\partial(r,\theta)} = 6r^3 \sin 2\theta$. 7+7

5. (a) Prove that $\int_0^1 \frac{x^2 dx}{\sqrt{1-x^2}} \times \int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}$.

(b) Change the order of integration and hence evaluate the integral $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{xdxdy}{\sqrt{x^2+y^2}}$. 7+7

6. (a) Apply double integration to calculate the volume generated by the revolution of the cardioid $r = a(1 + \cos \theta)$ about its axis.

~~(b)~~ Find the value of a so that the vector $\vec{F} = (ax^2 y + yz)\vec{i} + (xy^2 - xz^2)\vec{j} + (2xyz - 2x^2 y^2)\vec{k}$ is solenoidal. Also, find the curl of the vector \vec{F} . 7+7

7. (a) If $\vec{A} = (3x^2 + 6y)\vec{i} - 14yz\vec{j} + 20xz^2\vec{k}$, then evaluate $\int \vec{A} \cdot d\vec{R}$ from $(0,0,0)$ to $(1,1,1)$ along the path $x = t, y = t^2, z = t^3$.

~~(b)~~ Verify Green's theorem for $\int_C [(x^2 - \cosh y)dx + (y + \sin x)dy]$, where C is the rectangle with vertices $(0,0), (\pi, 0), (\pi, 1), (0,1)$. (7) 7+7