03   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Physics *(SH452)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ *All* questions carry equal marks.
✓ Assume suitable data if necessary.

1. Derive the resonance condition in an LCR circuit. Briefly explain the quality factor and hence show the quality factor will be higher if the band width of the circuit is lower.

2. What is Ultrasound? How these waves are produced? Write the fields of major application of Ultrasound.

3. Show that the wave equation of a transverse wave in a string is

    $$\frac{d^2y}{dx^2} = \frac{1}{v^2}\frac{d^2y}{dt^2}, \text{where } v = \sqrt{\frac{F}{\mu}}, \text{ where } \mu = \text{mass per unit length}$$

4. Explain how Newton's rings are formed and describe the method for the determinations of refractive index of liquid using Newton's ring formula.

    OR

    Discuss Fraunhofer diffraction due to a single slit. Draw a curve indicating distribution of intensity of diffraction patterns. Is there any fundamental difference between interference and diffraction? Give the reasons.

5. What is double Refraction? Explain how Nicol prism can be used as polariser and analyser?

6. A diffraction grating has 4000 lines per cm and is used at normal incidence. Calculate the dispersive power of the grating in the third order spectrum for the wavelength 500nm.

7. Write down the characteristics of LASER and its use in holography. How semi conductor laser is produced?

8. It is desired to make a converging achromatic lens of mean focal length 30 cm by using two lenses of materials A and B. If the dispersive powers of A and B are in the ratio 1:2. Find the local length of each lens.

9. Define electric flux. Determine electric field due to an infinite line of change.
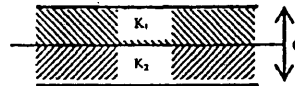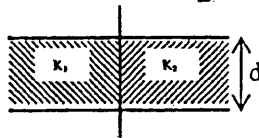
    OR

    What is dielectric constant? Prove the relation $\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$, Where symbols carry their usual meanings.

10. Two tiny conducting balls of identical mass **m** and charge **q** hang from non conducting thread each of length L. Derive and expression for the equilibrium separation 'x' between the balls assuming that the separation angle to be small.

    OR

    What is a damped em oscillations? Which factor in the circuit is responsible to produce such a motion? Derive a differential equation for this motion and write its solution. What will be the remedy of such motion to make it smooth?

11. A parallel plate capacitor contains two dielectric slabs (of equal dimensions) of dielectrics K_1 and K_2 as shown in figure below (i) Find the capacitance in each case if A is the area of each plate. (ii) If $K_1 = 2$ and $K_2 = 3$, what will be the ratio of the capacitance in two cases.

12. A p.d. of 1V is applied to a 30.5 m length of copper wire (diameter 0.02 inch). Calculate (i) The current (ii) Current density (iii) The electric field strength (Given, Resistivity of copper is $1.7 \times 10^{-8} \Omega m$).

13. Discuss the Hall Effect. Derive (i) Hall voltage (ii) Hall coefficient and (iii) Hall resistance. Explain that the Hall resistance leads to the quantum Hall effect.

14. Derive an expression for the magnetic flux density inside a long solenid, carrying current I, at a point nearits center.

OR

Derive an expression for growth and decay of current in inductance and resistance circuit. Also explain the decay current in LR circut.

15. Prove that charge conservation theorem with the help of maxwell's equation of electromagnetism.

16. Using the uncertainly principle, calculate the minimum uncertainty in velocity when an electron is confined to a box having a length 1nm. Given, $m = 9.1 \times 10^{-31}$ Kg, $h = 6.6 \times 10^{-34}$ Js.

***

2

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3-hrs.

Subject: - Engineering Physics (SH452)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ All questions carry equal marks.
✓ Assume suitable data if necessary.

1. Define centers of suspension and oscillation of compound pendulum and show that they are interchangeable. What length of the pendulum has its maximum time period?

OR

Derive a differential equation for LC oscillation. Show that the maximum value of electric and magnetic energies stored in LC circuit is equal.

2. What are basic conditions for acoustics of buildings? Derive Sabine's reverberation formula and also write its two importances.

3. A rod vibrating at 12Hz generates harmonics waves with amplitude of 1.5 mm in a string of linear mass density 2gm/m. If the tension in the string is 15N, what is the average power supplied by the source.

4. Explain the circular nature of the Newton's interference fringes. Show that square of radius of the nth bright fringe of Newton's ring due to the reflected light is proportional to 2n-1.

OR

Show that coherent light waves represented by equation $Ex = E_1 \sin(wt+\delta)$
$$Ey = E_2 \sin wt$$
Give rise generally to an elliptically polorised wave that can become linearly and circularly polorised wave under special condition.

5. What is the highest order spectrum which may be seen with monochromatic light of wavelength 600 nm by means of a diffraction grating with 4500 Lines/cm.

6. Write the physical significance of dispersive and resolving power of grating. Also establish the relation between them.

7. What is population inversion? Explain why laser action cannot occur without population inversion between atomic levels? Write a method for getting He-Ne Laser.

8. Two thin lens of focal length f_1 and f_2 separated by a distance d have equivalent focal length 50 cm. The combination satisfies the conditions for no chromatic aberration and minimum spherical aberration. Find the value of f_1, f_2 and d. Assume that both the lens are the same material.

9. What is quadruple? Derive an expression of the electric field intensity at a point due to quadruple at axial line?

OR

Find the expression for the electric field intensity at a point along the center perpendicular axis of the charge disk and distance z from center. Extend this result in infinite charge disk.

10. If copper coin has mass 3.11 gm, what is the total charge on the nucleus of the atoms in the coin? Also find number of protons inside the nucleus. Molar mass (M) = 63.5 gm/mole, Avogadro number (N_A) = 6.02×10^{23} atom/mole.

11. Discuss a microscopic view of ohm's law and show that resistivity of a conductor is independent of the external electric field.

OR

State and derive Ampere's law in magnetism. Why and how Maxwell modified it?

12. A circular coil having radius R carries a current I. Calculate the magnetic flux density at an axial distance x from the center of the coil. Explain how the coil bahaves for a large distance point and at what condition field will be maximum?

13. Find the expression for maximum energy of a rotating particle in a cyclotron. How cyclotron is different from synchrotron?

14. An inductance L is connected to a battery of emf **E** through a resistor. Show that the potential different across the inductance after time t is $V_L = Ee^{-(R/L)t}$. At what time is the potential difference across the inductance equal to that across the resistance such that $i = i_0/2$.

15. Write Maxwell equation in differential form. Convert them into internal form. Explain he physical significance of each of them.

16. Derive Schrodinger time independent wave equation. Explain the physical significance of the wave functions.
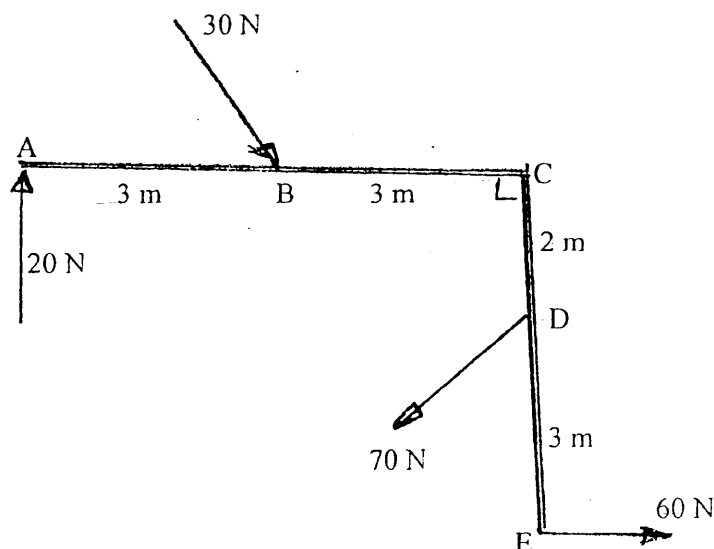
***

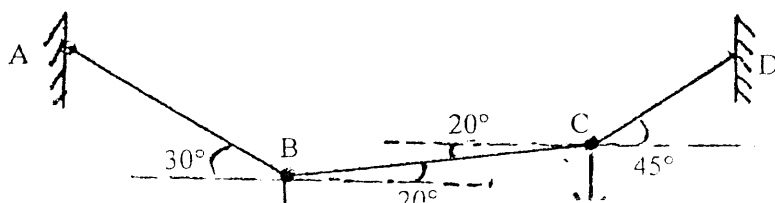| Exam.		**Back**	
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics *(CE451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
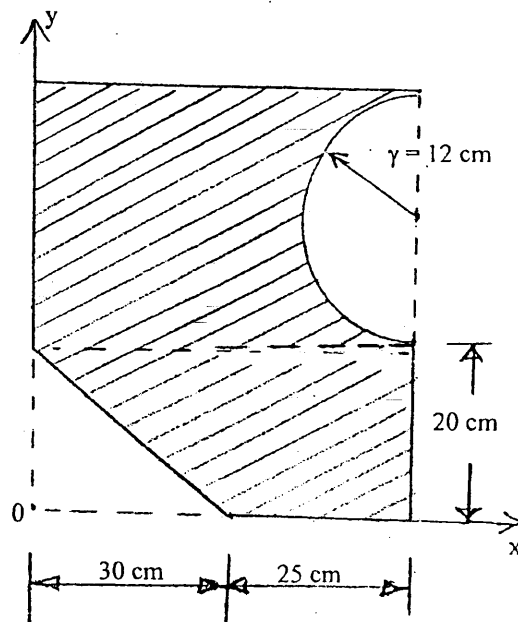✓ Assume suitable data if necessary.

1. What are the equations of Static Equilibrium for 2-D and 3-D analysis of particle and rigid body? [4]

2. Define particle, rigid body and free body diagram. Explain how can we reduce a force into a force and a couple. [3+2]

3. Determine magnitude, direction and line of action of the resultant of forces acting in the system as shown in figure below: [7]
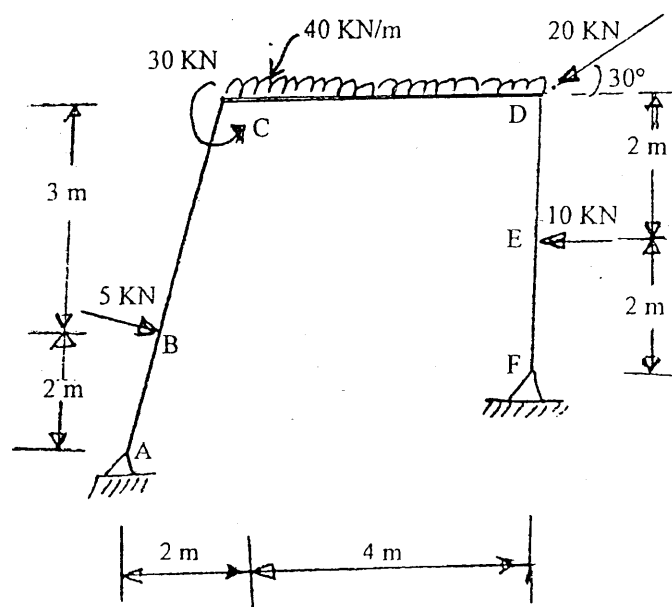

4. Determine the force in each cable and the force 'F' needed to hold the 20 kg lamp in the position shown in figure below: [6]
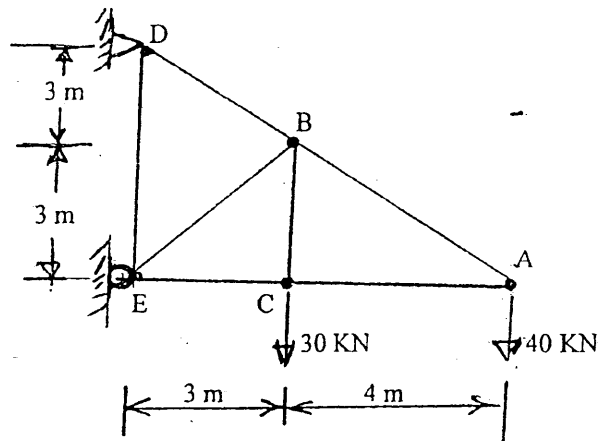
5. Define friction, angle of friction and explain how can we assure the condition of overturning or sliding of a block. [1+2+3]

6. Define centroid, center of gravity and axis of symmetry. Calculate the moment of inertia of the figure below (shaded area) about centroidal X-X axis. [3+9]

7. Draw AFD, SFD and BMD of the given frame loaded as shown in figure below. Indicate the salient features if any. [13]

6

8. Determine the force developed in the members BC, BE, BD and CE of the truss loaded as shown in figure below. What are the assumptions of ideal truss? [5+2]

9. The motion of a vibrating particle is defined by the equation $x = 100 \sin \pi t$ and $y = 25 \cos 2\pi t$. Where 'x' and 'y' are expresses in mm and 't' in sec. (a) Determine the velocity and acceleration when t = 1sec (b) Find the nature of the path of the particle. What do you mean by dependent motion explain with example? [8+2]

10. The resultant external force acting on a 3 kg particle in space is

$$\vec{F} = \left(12t\,\hat{i} - 24t^2\,\hat{j} - 40t^3\,\hat{k} \right) N,$$ Where 't' is time measured in seconds. The particle is at

rest at origin, when t = 0 sec. Determine the 'x' component of acceleration, velocity and position at the instant of 4 sec. Explain about impulse momentum principle of the particle. [8+2]

***

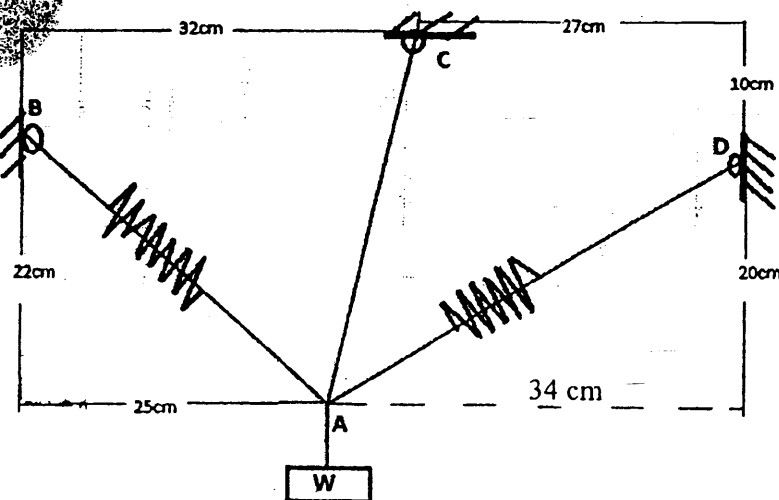| Exam.		**Regular**	
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics (CE451)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
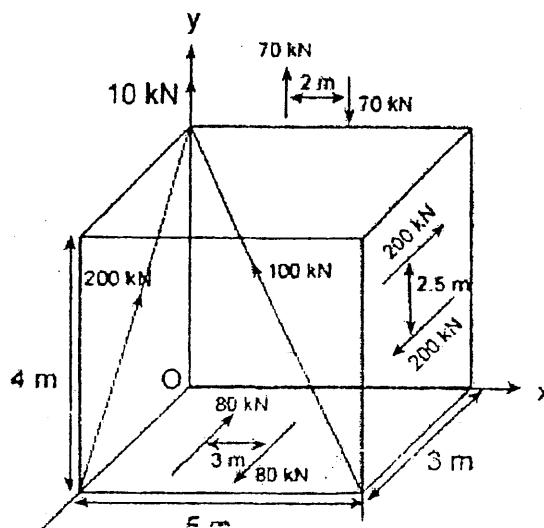✓ Assume suitable data if necessary.

1. What is Rigid body? Explain the transmissibility of force and its limitation.   [1+3]

2. A block of weight W is suspended by a cord AC and two spring of which the unstretched length of 25 cm knowing that the constants of spring are AB = 10N/cm and AD = 3.5N/cm. Determine: [8]
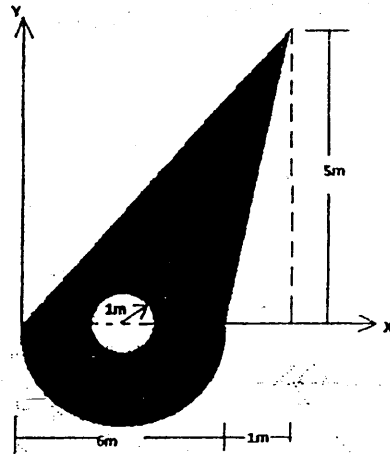
   a) Tension in the cord AC
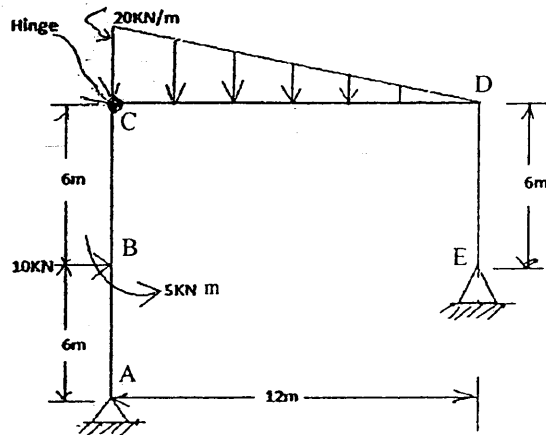   b) Weight of the block

3. State and prove varignon's theorem. Determine the resultant force and moment about point O.   [2+8]
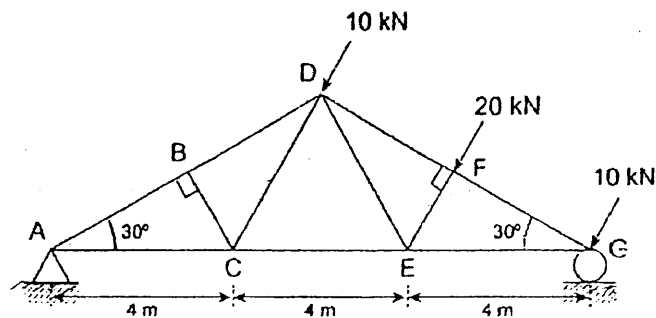
4. a) State and prove parallel axis theorem for moment of inertia. [4]

   b) Calculate moment of inertia of given shaded composite section about centrodial Y-Y axis. [8]
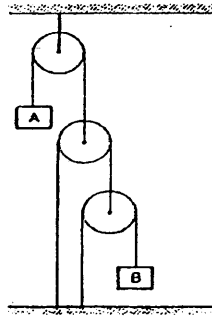

5. Define friction and explain about laws of dry friction. How condition of sliding or overturning can be decided for a block? Explain in brief. [2+2]

6. Draw AFD, SFD and BMD of given frame. Indicate salient features also. Deduce the relationship between load, shear force and bending moment for a beam section loaded uniformly with intensity of load w. [11+3]
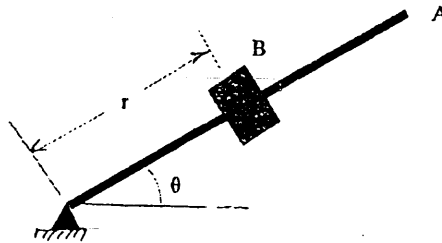

7. Find the member forces in BD, CE and CD for the given truss. Write down the assumptions of ideal truss. [6+2]

8. Define radial and transverse component of velocity and acceleration. Find the acceleration of block B if the acceleration of A is 4 m/s² (↓) for the following connection. Neglect the mass of blocks and pulleys. Assume that cords are inextensible and pulleys are friction less. [3+7]

9. Define angular momentum and illustrate that the rate of change of angular momentum about any point is equal to the momentum of the force about the point. The motion of a 1000 gm block B in a horizontal plane is defined by the relations $r = 3(1+\sin 2\pi t)$ and $\theta = 2\pi t$, where r is expressed in meters, t in seconds and θ in radians. Determine the radial and transverse components of the force exerted on the block when i) t = 0 and t = 0.5 sec. [3+7]
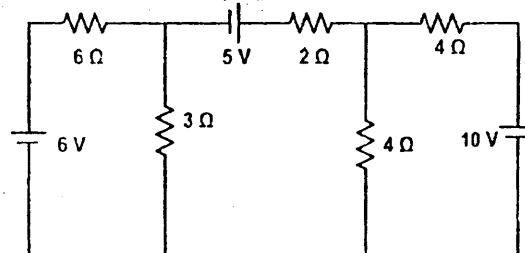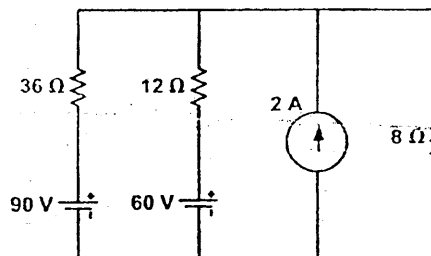

***

Subject: - Basic Electrical Engineering (EE451)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. a) Derive a relation between the known resistance R_1 at t_1 °C and the unknown resistance R_2 at t_2 °C, when α_0 is not known. [6]

   b) Explain the process of source conversion. How is it helpful in solving electrical networks? [4]

   c) A circuit, containing of three resistances 12 Ω, 18 Ω, and 36 Ω respectively jointed in parallel, is connected in series with a fourth resistance. The whole is supplied at 60 V and it is found that the power dissipated in the 12 Ω resistance is 36 W. Determine the value of the fourth resistance and the total power dissipated in the group. [6]

2. a) Find the branch currents in the circuit of given figure below by using nodal analysis? [6]
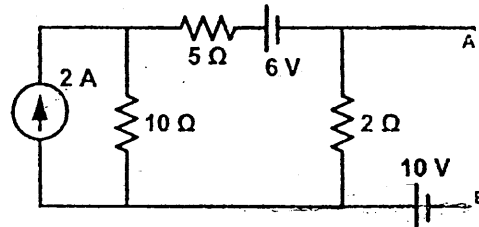

   b) Find current in 8 Ω resistor of the network shown in figure below using superposition theorem. [6]

   c) State and explain Thevenin's theorem with suitable example. [4]

3. a) In the network shown in figure below, find resistance R_L connected between terminals A and B so that maximum power is develop across R_L. What is the maximum power? [6]
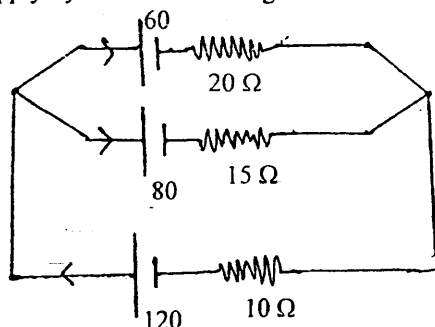

b) Derive an expression for the energy stored in the magnetic field of an inductor. [4]

c) Derive an expression for the current drawn by a pure capacitor when connected across a voltage. Explain with the help of a power diagram that the value of average power drawn by the capacitor during one cycle is zero. [6]

4. a) A resistance of 20 Ω, an inductance of 0.2 H and a capacitance of 100 μF are connected in series across a 220 V, 50 Hz supply. Determine the following (a) impedance (b) Current (c) Voltage across R, L and C and (d) Power factor. Also calculate the total power consumed by the circuit. [6]

b) A coil resistance 50 Ω and inductance 0.318 H is connected in parallel with a circuit comprising a 75 Ω resistor in series with a 159 μF capacitor. The resulting circuit is connected to a 240 V, 50 Hz ac supply. Calculate: (a) The supply current (b) The circuit impedance, resistance and reactance (c) Power factor and (d) Total power consumed by the circuit. [6]

c) Describe the method of measuring power in 3-Φ circuit by using two watt meters. [4]

5. a) A 220 V, 50 Hz single phase ac motor draws a power of 10 kW at a power factor of 0.75 lagging. Calculate the change in current taken from the supply and the new power factor when a 250 μF capacitor is connected in parallel with the motor. If the motor is supplied through a cable of 0.05 Ω resistances, calculate the power loss in the cable before and after connecting the capacitor. [8]

b) A three-phase Δ-connected load consists of three similar coils, each of resistance 50 Ω and inductance 0.3 H. The supply is 415 V, 50 Hz. Calculate (i) The line currents (ii) The power factor (iii) Total active and reactive powers when the load is Δ-connected. Draw the phasor diagram. [8]
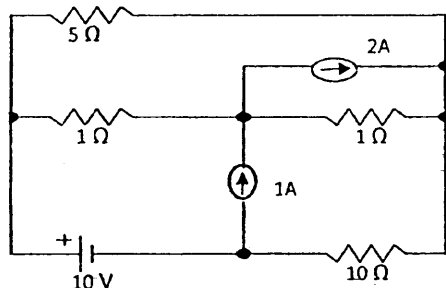
***

Subject: - Basic Electrical Engineering *(EE451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Define the terms of source transformation with suitable example. [4]

    b) The current in the field winding of a motor at 20°C is 2 A. After running the motor for 6 hrs at full load the current falls to 1.75 A. If the voltage applied across the field winding is 240 V, determine the temperature rise of the winding. The temperature coefficient of resistance of the copper winding at 0°C is 4.28×10^{-3}/K [6]

    c) A direct current circuit comprises two resistors, A value of 25Ω and B of unknown in series with the parallel group. The potential difference across C is found to 90V. If the total power in the circuit is 4320 w, Calculate value of unknown resistor. B, the voltage applied to the ends of the whole circuit and the current in each resistor. [6]

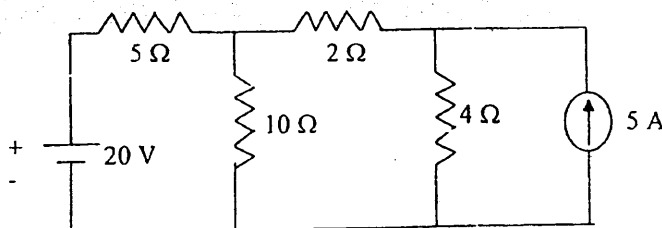2. a) Find the current supply by each source using Kirchhoff's law. [6]

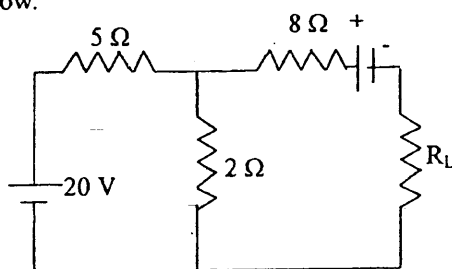   b) Find the current in the 10 Ω resistor in the circuit below using Superposition theorem. [6]

    c) Define capacitance and find the expression for capacitance in terms of physical dimension of capacitor also deduce energy stored in capacitor. [4]
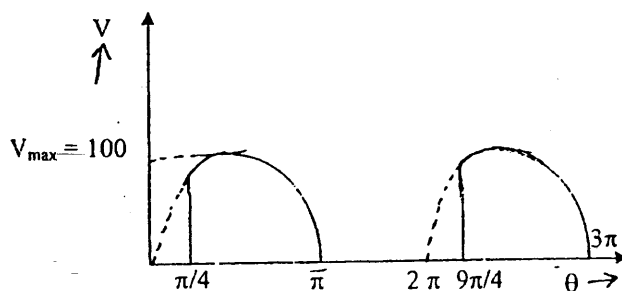
3. a) Use Norton's theorem to find the current through 10 ohm resistor for the network shown below. [8]

   b) State the maximum power transfer theorem and find the value of R_L to obtain the maximum in R_L power and also find the value of this maximum power for the network shown below. [8]

4. a) Calculate the peak factor and form of the waveform shown below. [4]

   b) A coil and non-inductive resistor are connected in series across a 200 V, 50 Hz supply. The voltage across the coil and resistor are 120 V and 140 V respectively. If the supply current is 0.5 A, calculate : (i) the resistance and inductance of the coil; (ii) the power dissipated in the coil; (iii) the power factor of the coil; (iv) the factor of the circuit. [6]

   c) Two impedances given by Z_1 = (10+j5) and Z_2 = (8+j6) are joined in parallel across a voltage of v = (200+j0) volts. Calculate the circuit its phase and the branch currents, total power consumed by the circuit. Draw the phasor diagram. [6]

5. a) Three phase loads (6+j8)Ω, (8+j6)Ω and (4-j3)Ω are connected in delta to a 3 phase 110 V supply. Find the phase currents, line currents and total power consumed. [6]

   b) Derive the relation between tan ϕ and the two wattmeter reading w1 and w2 for a balanced three-phase load having leading power factor. [6]

   c) Show, with the aid of a phasor diagram, how the power factor of a load can be improved by connecting a capacitor in parallel with it. [4]

***

14

Exam.		**Back**	
Level	BE	**Full Marks**	80
Programme	ALL (Except B. Arch.)	**Pass Marks**	32
Year / Part	I / II	**Time**	3 hrs.

Subject: - Engineering Mathematics II *(SH451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. State Euler's Theorem for homogeneous function of two variables. If $u = \tan^{-1}\left(\dfrac{x^3 + y^3}{x + y}\right)$

   then show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \sin 2u$. [1+4]

2. Obtain the maximum value of xyz such that $x + y + z = 24$. [5]

3. Evaluate: $\int_0^a \int_{\sqrt{ax}}^a \dfrac{y^2}{\sqrt{y^4 - a^2 x^2}} \, dy\, dx$ by changing order of integration. [5]

4. Evaluate: $\iiint_R (2x + y)\,dx\, dy\, dz$ where R is closed region sounded by cylinder $z = 4 - x^2$

   and planes $x = 0,\ y = 0,\ y = 2,\ z = 0$. [5]

5. Show that $\dfrac{x+4}{3} = \dfrac{y+6}{5} = \dfrac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$ are coplanar
   lines and find the point of intersection. [5]

6. Show that the shortest distance between the lines $x + a = 2y = -12z$ and
   $x = y + 2a = 6z - 6a$ is 2a. [5]

7. Obtain the equation of tangent plane to sphere $x^2 + y^2 + z^2 + 6x - 2z + 1 = 0$ which passes
   through the line $3(16 - x) = 3z = 2y + 30$ [5]

8. Find the equation of cone with vertex at $(3,1,2)$ and base $2x^2 + 3y^2 = 1,\ z = 1$ [5]

   OR

   Find the equation of the right circular cylinder whose guiding curve is the circle:
   $x^2 + y^2 + z^2 - x - y - z = 0,\ x + y + z = 1$

9. Solve the initial value problem: $y'' - 4y' + 3y = 10e^{-2x}$, $y(0) = 1,\ y'(0) = 3$ [5]

10. Solve the differential equation by power series method: $y'' - y = 0$ [5]

11. Solve in series, the Legendre's equation $(1-x^2)y''-2xy'+n(n+1)y=0$ [5]

OR

Prove the Bessel's function $J_{\frac{3}{2}}(x) = \sqrt{\dfrac{2}{\Pi x}}\left(\dfrac{\sin x}{x}-\cos x\right)$

12. Prove that $\left[\vec{a}\times\vec{b}\ \ \vec{c}\times\vec{d}\ \ \vec{e}\times\vec{f}\right] = \left[\vec{a}\ \vec{b}\ \vec{d}\right]\left[\vec{c}\ \vec{e}\ \vec{f}\right] - \left[\vec{a}\ \vec{b}\ \vec{c}\right]\left[\vec{d}\ \vec{e}\ \vec{f}\right]$ [5]

13. Prove that the necessary and sufficient conditions for the vector function $\vec{a}$ of scalar

variable t to have constant direction is $\vec{a}\times\dfrac{d\vec{a}}{dt}=0$ [5]

14. Find the angle between the normal to the surfaces given by: $x\log z = y^2-1$ and
    $x^2y+z=2$ at the point $(1,1,1)$ [5]

15. Test the convergence of the series: [5]

$x+\dfrac{3}{5}x^2+\dfrac{8}{10}x^3+\dfrac{15}{17}x^4+......+\dfrac{n^2-1}{n^2+1}x^n+......,x>0.$

16. Find the interval and radius of convergence of power series: [5]

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

* * *

Exam.		Back	
Level	BE	Full Marks	40
Programme	All (Except B. Arch)	Pass Marks	16
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Drawing II *(ME451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Draw an isometric view from the given orthographic views as shown in figure below: [10]

2. Draw the angular perspective view of figure below: [5]

3. Orthographic projection of the object is shown in figure below. Draw the sectional view at section A-A. [5]

SLOT 80×40 DEEP 50

4 HOLES 30×15

OR

Draw the standard symbols for the following:

a) External Thread
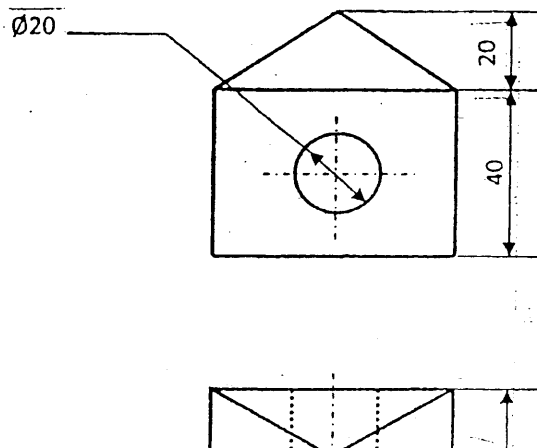b) First angle projection
c) Projection welding
d) Nipple
e) Material removed by milling
f) Maximum material condition
g) Thermistor
h) Three phase motor
i) Channel
j) Church

4. Sketch the top view and sectional front view for double riveted double strap chain butt joint. [5]

OR

Make complete fit analysis of the following symbols 100H11/p7; fundamental deviations for H and p are 0.00 mm and 0.037 mm respectively. ITG for 11 and 7 are 0.22 mm and 0.035 mm respectively. Indicate type of fit, allowance and type of system.

5. Draw the assembled sectional front view from the following detail drawings shown in figure below. [15]

15
30
φ18
80

30

15

SUPPORTS
Cold Rolled Steel
1 OFF EACH

φ14

80

80

80
φ24
M16
12   50

CYLINDRICAL HEAD SCREW
Steel
1 OFF

24
14

φ80
φ60
φ18

WHEEL
Cast Iron
1 OFF

126
15

2× M12

80

220

BASE
Cold Rolled Steel
1 OFF

φ36
3
φ18

WASHER
Bronze
2 OFF

2.5

M 12 HEX BOLT
Mild Steel
2 OFF

M 16 HEX NUT
Mild Steel
1 OFF

***

Subject: - Engineering Drawing II *(ME451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate Full Marks.*
✓ *Necessary figures are attached herewith.*
✓ *Assume suitable data if necessary.*

1. Orthographic views of an object are shown in figure below, Draw its isometric view. [10]

2. A solid square prism of side base 30 mm and height 40 mm rests with its base on the ground and one of the rectangular faces inclined at 30 degree to the PP. the nearest vertical edges touches the pp. the Station point is 80 mm in front of the pp, 80 mm above the ground and opposite to the nearest vertical edge that touches the pp. Draw the perspective view and indicate main dimensions. [5]

3. Draw sectional front view from the component as shown in figure below. [5]

4. Draw the front view and full sectional top view of double riveted double strap chain type butt joint. [5]

OR

Determine the limits of dimensions and types of fit designed by 50H8/d9. Assume fundamental deviation for H and d as 0 micrometers above the size and 0.080 mm below the basic size line respectively and international tolerance grade for 8 and 9 as 0.039 mm and 0.062 mm respectively.

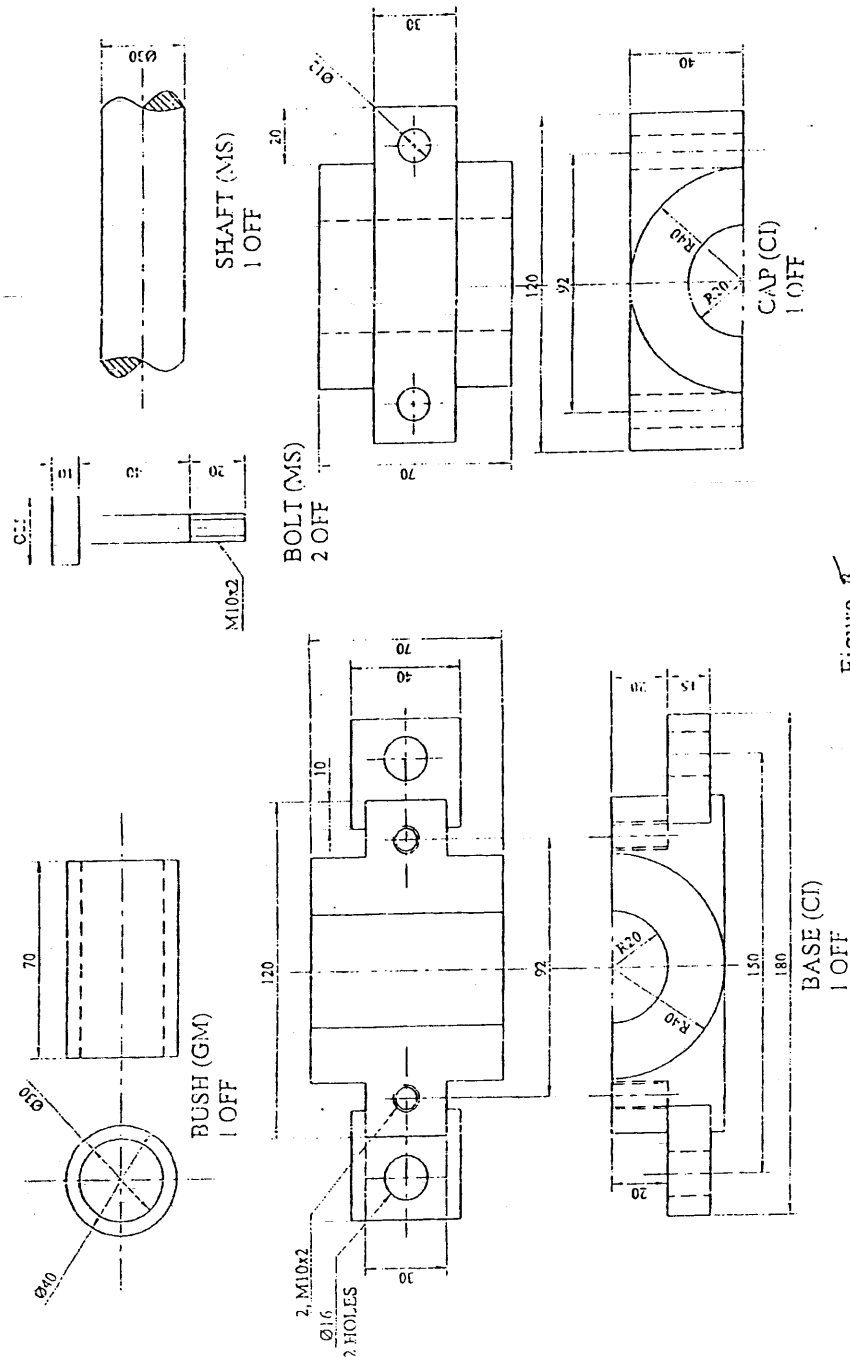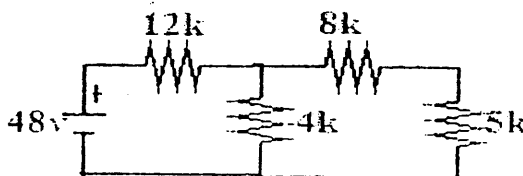5. Draw the assembled sectional front view from the detail drawing in figure 5 (attach with Question) [15]

Figure 5

Exam.		**Back.**	
Level	BE	**Full Marks**	80
Programme	All (Except B. Arch)	**Pass Marks**	32
Year / Part	I / II	Time	3 hrs.

Subject: - Basic Electronics Engineering *(EX451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Determine Vth, Rth and the current through 5 KΩ resistor using Thevenin's theorem.   [4]
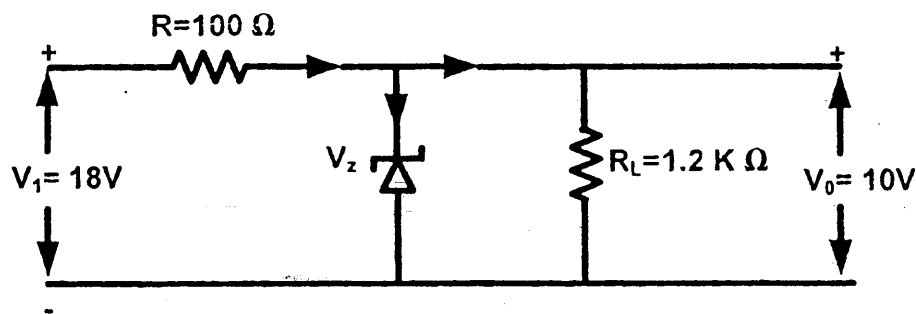

2. What do you mean by a filter circuit? Explain the operation of RC low pass filter with its transfer function and frequency response.   [4]

3. Explain large signal models of PN junction diode.   [4]

4. Explain the working principle of full wave bridge rectifier with necessary diagrams and expressions.   [4]

5. Draw the DC load line and determine the Q point of the voltage divider biased transistor circuit having V_{CC} = 20v, RC = 2K, R1 = 20k, R2=10k, RE=4k, β=100.   [6]

6. Describe the construction and working principle of n-channel depletion type MOSFET with necessary diagrams.   [6]

7. Explain the operation of CMOS invertor with necessary diagram.   [4]

8. Describe the working principle of square wave generator circuit using operational amplifier.   [4]

9. What do you mean by virtual short circuit in OP amp? Draw the circuit diagram of the inverting integrator and show that the output is proportional to the time-integral of the input.   [2+2+2]

10. State Barkhausen criteria for oscillation. Draw Wein bridge oscillator circuit to generate sine wave and derive the frequency of the generate sine wave.   [2+2+2]

11. Explain working principle of optical fiber. List out the advantages of optical fiber communication over copper cable communication.   [2+4]

12. Write short notes: (any two)   [2×3]

    i) Data Logger
    ii) Digital Multimeter (DMM)
    iii) Regulated Power Supply

13. What is an anetenna? Explain any two properties of the antenna.   [2+2]

14. Simply the expression using K-Map, F(A,B,C)=A'B+BC'+AC'.   [4]

15. Explain the operation of JK flip-flop with necessary diagrams and characteristic table.   [6]

16. What is multiplexer (MUX) Explain 4:1 Multiplexer.   [6]

***

Exam.	**Regular**		
Level	BE	Full Marks	80
Programme	All (Except B. Arch)	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Basic Electronics Engineering *(EX451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What is Active and Passive Component? Define transconductance and voltage gain with reference to BJT.   [2+4]

2. Draw the circuit diagram of RC High pass filter and explain its operation with the help of frequency dependent response at the output.   [5]

3. Find the Zener Current in the given circuit when $R_L = 1.2$ KΩ. Assume $V_Z = 10$ V.   [5]
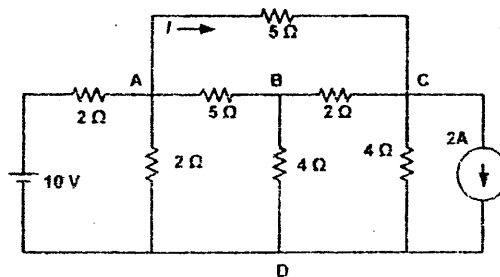

4. What is clipper and clamper circuit?   [2]

5. Draw emitter feedback bias circuit of BJT by labeling all the circuit components. Find I_C and V_{CE} in the circuit if $V_{CC} = +12$ V, $R_B = 430$ kΩ, $R_C = 2$ kΩ, $R_E = 1$ k Ω and $\beta = 50$.   [2+4]

6. Draw the circuit diagram of differential amplifier using BJT.   [2]

7. Describe the working principle of n-channel enhancement type MOSFET.   [6]

8. Mention any four properties of ideal Op-amp. Derive the expression of voltage gain of non-inverting amplifier using Op-amp.   [2+4]

9. State Barkhausen criteria. Draw the circuit diagram of square wave generator and explain how it works.   [2+4]

10. Draw the circuit diagram of Wien Bridge oscillator.   [4]

11. Differentiate between following communication systems.   [3+3]

    i) Wired and wireless communication system
    ii) Broadcasting and communication

12. What are the advantages and disadvantages of optical communication system? [4]

13. Write short notes on: (any two)   [2×3]

    i)   Oscilloscope
    ii) Data logger
    iii) Regulated power supply using IC

14. State DeMorgan's theorem. Subtract $(1111)_2$ from $(1110)_2$ using 2's complement method.   [3+3]

15. Simplify an expression $F(A,B,C,D) = \sum(1,3,7,9,11,14,15)$ by using K-map.   [4]

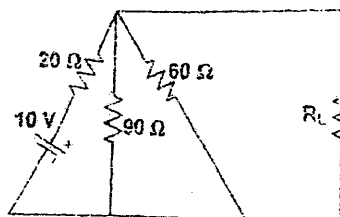| Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Basic Electrical Engineering *(EE451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) What do you mean by ideal and practical voltage source? Explain the effect of an internal resistance of a voltage source on its terminal characteristic. [4]

   b) Define temperature co-efficient of resistance. The field winding of a dc motor connected across 230 V supply takes 1.15 A at room temperature of 20°C. After working for some hours the current falls to 0.96 A, the supply voltage remaining constant. Calculate the final working temperature of field winding. Resistance temperature co-efficient of copper at 20°C is 1/254.5. [6]

   c) A direct current circuit comprises two resistors, A of value 25 Ω, and B of unknown value, connected in parallel, together with a third resistor C of value 5 Ω connected in series with the parallel group. The potential difference across C is found to 90 V. If the total power in the circuit is 4320 W, calculate value of unknown resistor B, the voltage applied to the ends of the whole circuit and the current in each resistor. [6]

2. a) Calculate the current flowing in the 5Ω branch AC of the circuit shown in figure below using nodal analysis. [8]
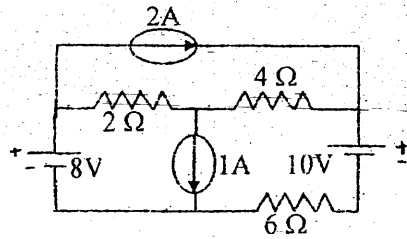

   b) Calculate the value of R to receive maximum power and maximum power received by it for the circuit shown below. [8]

3. a) Use loop current method to calculate the current through the 4 Ω resistance for the network shown below. [8]

b) State and explain Norton Theorems with the help of suitable example. [4]

c) What is a parallel-plate capacitor? How do you define its capacitance? [4]

4. a) Derive the equation for inductance in terms of its physical dimensions. [4]

b) Derive the equation for instantaneous current flowing through a pure inductor when excited by AC sinusoidal voltage V = Vm Sinwt. Draw the waveform of voltage, current and power. Show analytically and graphically that it does not consume real power. [6]

c) A series circuit consists of a resistance equal to 4Ω and inductance of 0.01 H. The applied voltage is v = 283 sin (300t+90°) volts. Find [6]

(i) the power dissipated in the circuit,
(ii) the expression for i(t)
(iii)power factor

5. a) Define power factor and explain its significance. A single phase load of 5Kw operates at a power factor 0.6 lagging. It is proposed to improve the power factor to 0.95 lagging by connecting a capacitor across the load. Calculate the KVAr rating of the capacitor. [2+6]

b) A star connected alternator supplies a delta connected load. The impedance of the load branch is (8+j6) Ω. The line voltage is 230 volt. Determine [8]

(i) Current in the load branch
(ii) Power consumed by load
(iii) Power factor of the load
(iv) Reactive power of the load

***

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Physics (SH452)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ All questions carry equal marks.
✓ Assume suitable data if necessary.

1. Show that motion of a disk of a torsion pendulum is angular harmonic motion. Find an expression for its angular frequency and time period of oscillation.

OR

What is em oscillation? Derive the differential equation of forced em oscillation. Hence find its resonance frequency.

2. A mass of 2 kg is suspended from a spring of spring constant 18 N/m. If the undamped frequency is $2/\sqrt{3}$ times the damped frequency, what will be the damping factor?

3. The volume of a hall is 475 m^3, the area of the wall is 200 m^2, areas of the floor and ceiling each is 100 cm^2. If absorption coefficients of the wall, ceiling and floor are 0.03, 0.04 and 0.05 respectively, find the reverberation time for the hall.

4. Is it necessary that the interfering waves should have equal amplitude? Derive an expression for condition of constructive and destructive interferences for reflected light in case of thin transparent film of uniform thickness.

OR

What are dispersive power and resolving power of a diffraction grating? Show that the resolving power of a grating is proportional to the number of order.

5. White light falls normally on a film of soapy water of thickness 5×10^{-5} cm and refractive index 1.33. Which wavelength in the visible region will be reflected most strongly?

6. What are retardation plates? Find out an expression to find the thickness of a retardation plate that produces elliptically polarized light.

7. Derive the expression for the equivalent focal length of two thin lenses having focal lengths f_1 and f_2 separated by a distance d. Also find the position of principal points.

8. If the numerical aperture be 0.2441 and refractive index of core be 1.50, calculate the refractive index of the cladding and acceptance angle in an optical fiber.

9. What is quadrupole moment? Is it vector quantity? Derive an expression of electric field intensity due to linear quadrupole at axial line.

OR

What is electric flux? Is it scalar quantity? Use Gauss's law to find the electric field strength outside and inside of uniformly charge distributed conducting sphere of radius R.

10. If a parallel plate capacitor is to be designed to operate in an environment of fluctuating temperature, prove that the rate of change of capacitance C with temperature T is given by $\frac{dC}{dT} = C\left[\frac{1}{A}\frac{dA}{dT} - \frac{1}{x}\frac{dx}{dT}\right]$, where symbol carries its usual meaning.

11. The super conducting state of a lead specimen has critical temperature 6.2 K at zero magnetic field and the critical field is 6.4×10^4 A/m at 0 K. Estimate the critical field at 5K.

12. An inductance L is connected to battery of emf E through a reisistance. Show that the inductor affects the growth of current $i = i_0\left(1 - e^{-\left(\frac{Rt}{L}\right)}\right)$. At which condition it reduces to $0.63i_0$.

OR

Derive an expression for energy stored in magnetic field. Show that the magnetic energy density is directly proportional to the square of magnetic field.

13. A copper strip 2 cm wide and 1 mm thick is placed in magnetic field 1.5T. If a current of 200A is setup in the strip, calculate (a) Hall voltage (b) Hall mobility of the number of elections per unit volume is 8.4×10^{28} m^{-3} and resistivity is 1.72×10^{-8} ohm-m.

14. A parallel plate capacitor with circular plates is being charged by varying electric field of 1.5×10^{12} Vm^{-1}s^{-1}. Evaluate the induced magnetic field if the radius of the plate is 55 mm and displacement current.

15. Write down the Maxwell's equations in free space and in dielectric medium. With the help of Maxwell's equations, derive charge conservation theorem.

16. An electron is confined in an one dimensional infinite potential well of width l, the potential energy is $V(x) = \begin{cases} 0 & 0 \le x \le l \\ \infty & x < 0 \text{ and } x > l \end{cases}$. Find the eigenfunctions $\Psi_n(x) = A\sin\left(\frac{n\pi x}{l}\right)$ and energy eigenvalues $E_n = \frac{n^2\pi^2 h^2}{2ml^2}$.

***

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics (CE451)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
✓ *The figures in the margin indicate __Full Marks__.*
✓ *Assume suitable data if necessary.*

1. What is applied mechanics? Mention scope of applied mechanics in engineering. [1+2]

2. What is free body diagram? Determine the support reaction at contact point of given system. Assume contact surfaces are smooth. [1+7]
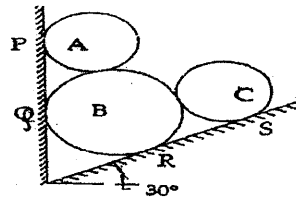
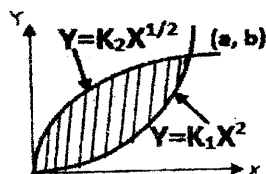   Take,
   Weight of sphere A and C = 300N
   Weight of sphere B = 600N
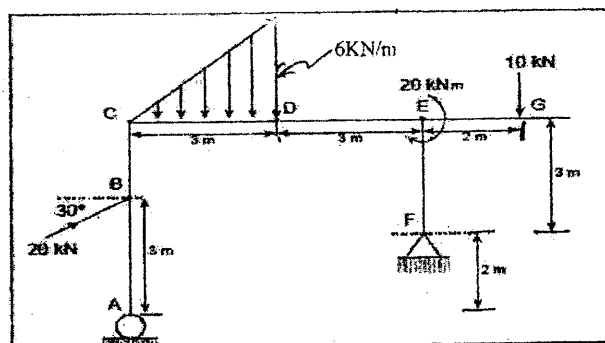   Diameter of A and C = 800mm
   Diameter of B = 1200mm

3. State and prove the parallel axis theorem for moment of inertia. Determine the moment of inertia about centroidal 'Y' axis of given shaded area. [4+8]
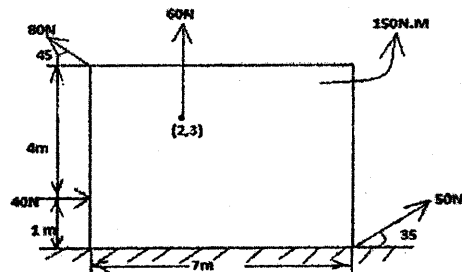

4. Define angle of friction, coefficient of friction. Why coefficient of static friction is greater than coefficient of kinetic friction. [1+1+2]

5. Draw axial force, shear force and bending moment diagram; and obtain salient features for the given frame Loaded as shown in figure. [13]
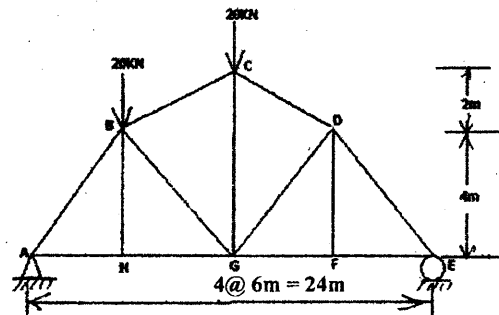
6. The acceleration of a particle is defined by the relation a = 12x-28 where a in m/s^2 and x in m. knowing that v = 8m/s when x = 0; determine   [8+2]
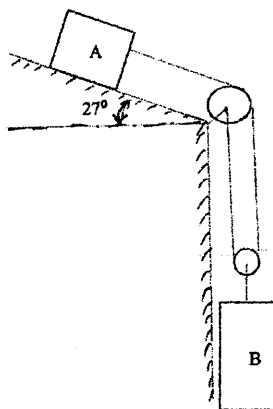
   a) the maximum value of x.
   b) the velocity when the particle has travelled a total distance of 3m.
   c) What do you mean by dependent motion of particle? Explain with suitable example.

7. Explain free body diagram and its importance. Find the magnitude, direction of resultant force and locate two points on the edge of the plate where the resultant meet.   [4+8]

8. Determine the member force in members BC, BG and DF. How can we check the determinacy and stability of the truss? Explain with suitable example.   [5+3]

9. Derive the expression for angular momentum and rate of change. Two blocks, A of mass 150 kg and block B of mass 350 kg, shown starts from rest. The coefficient of friction between horizontal plane and the pulley is 0.2 and the pulleys assumed to be of negligible mass. Determine the acceleration of each block and tension in each chord.   [2+8]
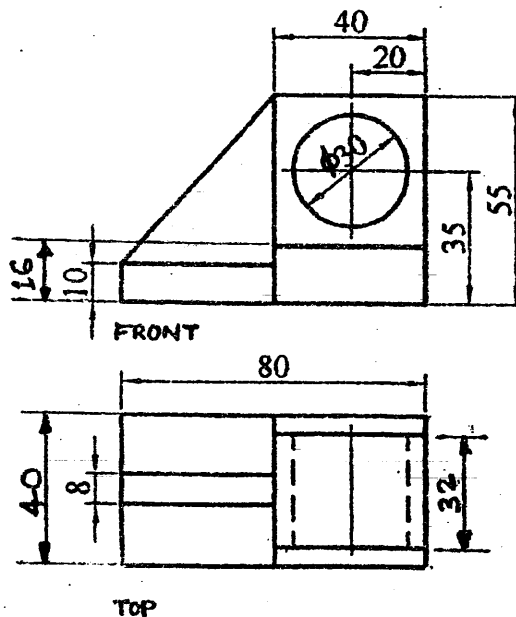

***

Subject: - Engineering Drawing II *(ME451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Orthoghraphic views of an object is shown in figure below. Draw its isometric view. [10]

2. A right regular square pyramid, base edge 30 mm and altitude 40 mm rests with its base on the ground and the base edges are equally inclined to the picture plane. The nearest front corner of the base is 10 mm behind the PP. The station point is 45 mm in front of the PP, 60 mm above the ground and lies in the central plane which passes through the vertex of the pyramid. Draw the perspective view of the pyramid. [6]

3. Draw the assembled sectional front view from the following detail drawings shown in figure below. [14]
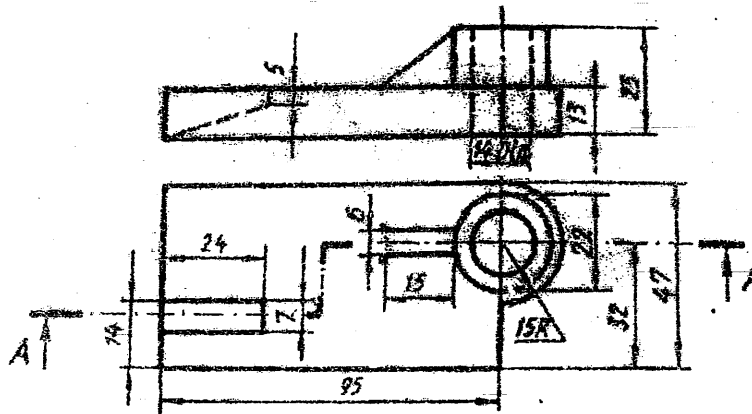

SUPPORTS
Cold Rolled Steel
1 OFF EACH

CYLINDRICAL HEAD SCREW
Steel
1 OFF

WHEEL
Cast Iron
1 OFF

BASE
Cold Rolled Steel
1 OFF

WASHER
Bronze
2 OFF

M 12 HEX BOLT
Mild Steel
2 OFF

M 16 HEX NUT
Mild Steel
1 OFF

4. Sketch top view and sectional front view of single riveted double strap butt joint.   [5]

OR

Determine the limits of dimensions and types of fit designed by 100 H7/s6. Assume fundamental deviation for H and s as 0 micrometers and 0.030 mm above the basic size line respectively and International tolerance grade for 7 and 6 as 0.035 mm and 0.022 mm respectively.   [5]

5. Orthographic projection of the object is shown in figure below. Draw the sectional view at section A-A.   [5]

OR

Draw the standard symbols for the following.

a) Internal Thread   b) Third angle projection
c) Spot weld   d) Expansion joint
e) Surface to be obtained by fine turning   f) Least material condition
g) Rectifier   h) Loud speaker
i) I - beam   j) School

***

Exam.		Regular	
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Engineering Mathematics II (SH451)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ _All_ questions carry equal marks.
✓ Assume suitable data if necessary.

1. State Euler's Theorem for a homogeneous function of two independent variables and verify it for the function $u = x^n \tan^{-1}\left(\dfrac{y}{x}\right)$

2. Find the extreme value of $x^2+y^2+z^2$ connected by the relation $ax+by+cz = p$.

3. Evaluate $\iint xy(x + y)\,dxdy$ over the area between $y = x^2$ and $y = x$.

4. Evaluate the integral by changing to polar coordinates $\int_0^a \int_0^{\sqrt{a^2-x^2}} y^2 \sqrt{x^2 + y^2}\,dy.dx$

   ### OR

   Find by triple integration the volume of the sphere $x^2+y^2+z^2 = a^2$.

5. Find the equation of the plane through the line $2x+3y-5z = 4$ and $3x-4y+5z = 6$ and parallel to the coordinate axes.

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

7. Obtain the centre and radius of the circle $x^2+y^2+z^2+x+y+z = 4$, $x+y+z = 0$.

8. The plane through OX and OY includes an angle α, prove that their line of intersection lies on the cone $z^2(x^2 + y^2 + z^2) = x^2 y^2 \tan^2 \alpha$

   ### OR

   Find the equation of the right circular cylinder of radius 2 whose axis is the line $\dfrac{x-1}{1} = \dfrac{y-2}{1} = \dfrac{z-3}{2}$.

9. Solve by power series method the differential equation $y'' - 4xy' + (4x^2 - 2) y = 0$,

10. Express $f(x) = x^3 - 5x^2 + x + 2$ in terms of Legendre's polynomial.

11. Show that $J_{-\left(\frac{5}{2}\right)}(x) = \sqrt{\dfrac{2}{\pi x}}\left(\dfrac{3}{x}\sin x + \dfrac{3-x^2}{x^2}\cos x\right)$.

12. Prove that $\left[\vec{b}\times\vec{c}\ \ \vec{c}\times\vec{a}\ \ \vec{a}\times\vec{b}\right] = \left[\vec{a}\ \vec{b}\ \vec{c}\right]^2$

13. A partical moves along the curve $x = a\cos t$, $y = a\sin t$ and $z = bt$. Find the velocity and acceleration at $t = 0$ and $t = \pi/2$.

14. Find the directional derivative of $\phi(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of vector $\vec{i} + 2\vec{j} + 2\vec{k}$.

OR

If $\vec{a}$ is a constant vector and $\vec{r}$ be the position vector then prove that $(\vec{a}\times\nabla)\times\vec{r} = -2\vec{a}$.

15. Test the convergence of the series

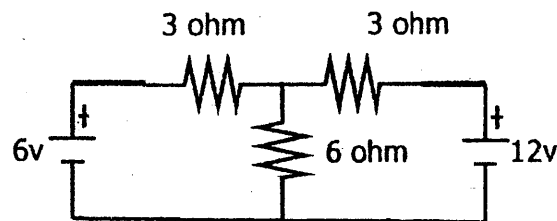$$\frac{x}{1.2} + \frac{x^2}{2.3} + \frac{x^3}{3.4} + \dots\dots\dots, x > 0$$

16. Find the interval and radius of convergence of the power series $\sum_{n=1}^{\infty}\frac{(-3)^n x^n}{\sqrt{n+1}}$.

***

Exam.		Regular	
Level	BE	Full Marks	80
Programme	All (Except B. Arch.)	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Basic Electronics Engineering *(EX451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Describe different types of controlled source with figures. [4]

2. Calculate the current flowing in each branch using superposition theorem. [6]

3. Describe the rectification process. Explain the operation of half wave rectifier with necessary diagrams. [1+4]

4. What is diode clamper? Describe the operation diode clamper circuit. [1+4]

5. Draw the DC load line and determine the Q point of the voltage divider biased transistor circuit having V_{cc} = 15v, R_c = 1kΩ, R_1 = 10 kΩ, R_2 = 5kΩ, R_c = 2kΩ and β = 75. [6]

6. Why BJT is a bipolar and MOSFET is an unipolar device? And draw the circuit diagram of differential amplifier using BJT. [2+2]

7. Explain the operation of CMOS switch with necessary diagrams. [4]

8. Mention any four properties of an ideal OP amp. Derive the expression of voltage gain of an inverting amplifier using OP amp. [2+4]

9. Draw a circuit diagram of square wave generator using OP amp. Explain how it generates the square wave. Express the frequency of the square wave generated. [2+3+1]

10. What is Optical fiber? Explain the advantages of optical fiber communication over coaxial cable communication. [1+3]

11. Define communication system. And describe communication system in brief with the complete block diagram. [2+3]

12. Simplify the expression using K-Map, $F(x,y,z)$ = X'YZ+X'Y'Z+XYZ and realize it using logic gates. [5]

13. Mention the types of flip flops and explain the operation of J-K flip flop with necessary diagrams. [1+4]

14. Draw a block diagram of digital multimeter. Explain how it measures dc current flowing through it. [5]

15. Draw and explain the block diagram of data logger. [4]

16. Write short notes on: (any two) [2×3]
    a) Light emitting diode
    b) Output characteristics of common base configuration
    c) Regulated power supply

***