## [5351]-101

### F.E.

# ENGINEERING MATHEMATICS-I
## (2015 Pattern) (Semester - I & II) (Credit System)

*Time : 3 Hours]*                                                    *[Max. Marks : 50*
*Instructions to the candidates:*
  1) *Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 and Q. 7 or Q. 8.*
  2) *Neat diagram must be drawn wherever necessary.*
  3) *Figures to the right indicate full marks.*
  4) *Use of, electronic pocket calculator allowed.*
  5) *Assume suitable data, if necessary.*

*Q1)* a)   Reduce the following matrix to its normal form and hence find its rank.
**[4]**

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

b)   Find the eigen values and eigen vectors of :                         **[4]**

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

c)   If $\tan(\alpha + i\beta) = x + iy$, then prove that $x^2 + y^2 + 2x\cot 2\alpha = 1$ and $x^2 + y^2 - 2y\coth(2\beta) + 1 = 0$.                                          **[4]**

OR

*Q2)* a)   If $\alpha$ and $\beta$ are roots of equation $Z^2 \sin^2\theta - Z\sin 2\theta + 1 = 0$, prove that $\alpha^n + \beta^n = 2\cos n\theta.\csc^n\theta$, where $n$ is integer.                  **[4]**

b)   Prove that $\tan\left\{i\log\left(\dfrac{a-ib}{a+ib}\right)\right\} = \dfrac{2ab}{a^2-b^2}$ using principal value of logarithm.                                                         **[4]**

c)   Examine Linear dependence of vectors $x_1 = (2, -1, 3, 2), x_2 = (1, 3, 4, 2),$ $x_3 = (-1, -4, 1, 0)$. If dependent find the relation among them.   **[4]**

*Q3)* a)    Solve any one :                                                                          [4]

    i)    Test the convergence of the series $\sum\limits_{n=1}^{\infty}\dfrac{(n+1)x^{n}}{n^{2}}$.

    ii)    Test the convergence of the series $1-\dfrac{1}{3}+\dfrac{1}{9}-\dfrac{1}{27}+........$

b)    Expand $3x^{3}-2x^{2}+x-4$ in powers of $(x+2)$ using Taylor's theorem.

                                                        [4]

c)    Find the $n^{\text{th}}$ derivative of $y=\cos^{-1}\left(\dfrac{x-x^{-1}}{x+x^{-1}}\right)$.                                   [4]

*Q4)* a)    Solve any one :                                                                          [4]

    i)    $\lim\limits_{x\to 0}\left(\dfrac{2^{x}+3^{x}}{2}\right)^{1/x}$

    ii)    $\lim\limits_{x\to 0}\dfrac{xe^{x}-\log(1+x)}{x^{2}}$

b)    Show that :                                                                                  [4]

$$(1+x)^{x}=1+x^{2}-\dfrac{1}{2}x^{3}+\dfrac{5}{6}x^{4}-\dfrac{3}{4}x^{5}+.......$$

c)    If $y=e^{\tan^{-1}x}$, then prove that

$$(1+x^{2})y_{n+2}+\left[2(n+1)x-1\right]y_{n+1}+n(n+1)y_{n}=0$$                                   [4]

*Q5)* Solve any two :

a)    If $u=2x+3y$, $v=3x-2y$ find the value of $\left(\dfrac{\partial u}{\partial x}\right)_{y}\left(\dfrac{\partial x}{\partial u}\right)_{v}\left(\dfrac{\partial y}{\partial v}\right)_{x}\left(\dfrac{\partial v}{\partial y}\right)_{u}$.

                                                             [6]

b) If $u = \operatorname{cosec}^{-1}\left(\sqrt{\dfrac{x^{1/2} + y^{1/2}}{x^{1/3} + y^{1/3}}}\right)$, show that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{12}\left(\frac{13}{12} + \frac{\tan^2 u}{12}\right).$$   [7]

c) If $z = f(x, y)$ where $x = u + v$, $y = uv$, then prove that

$$u \frac{\partial z}{\partial u} + v \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} + 2y \frac{\partial z}{\partial y}$$   [6]

OR

**Q6)** Solve any two :

a) If $u = \log(x^3 + y^3 - x^2 y - xy^2)$, prove that $\left(\dfrac{\partial}{\partial x} + \dfrac{\partial}{\partial y}\right)^2 u = \dfrac{-4}{(x + y)^2}$.   [6]

b) If $u = \dfrac{x^3 + y^3}{x + y} + \dfrac{1}{x^5} \sin^{-1}\left[\dfrac{x^2 + y^2}{x^2 + 2xy}\right]$, find the value of

$$x^2 = \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} \text{ at the point } (1, 2).$$   [7]

c) If $u = x^2 - y^2$, $v = 2xy$ and $z = f(u, v)$ then show that

$$x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y} = 2\sqrt{u^2 + v^2} \frac{\partial z}{\partial u}.$$   [6]

**Q7) a)** If $ux + vy = a, \dfrac{u}{x} + \dfrac{v}{y} = 1$, prove that $\left(\dfrac{\partial u}{\partial x}\right)_y - \left(\dfrac{\partial v}{\partial y}\right)_x = \dfrac{x^2 + y^2}{y^2 - x^2}$.   [4]

b) In calculating the volume of a right circular core, errors of 2% and 1% are made in measuring the height and radius base respectively. Find the error in the calculated volume.   [4]

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c)  Find the stationary points of the function

$f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$. Examine for maxima and minima at there points. **[5]**

OR

**Q8) a)** If $u = x + y^2, v = y + z^2, w = z + x^2$ find $\dfrac{\partial x}{\partial u}$. **[4]**

b)  If $u = x + y + z$, $v = x^2 + y^2 + z^2$, $w = xy + yz + zx$. Examine whether $u, v, w$ are functionally dependent. If so find the relation between them. **[4]**

c)  Find the stationary value of $u = x^m y^n z^p$ under the condition $x + y + z = a$. **[5]**

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## [5351] - 102
### F.E.
## BASIC CIVIL AND ENVIRONMENTAL ENGINEERING
### (2015 Pattern) (Semester - II)

*Time : 2 Hours]*                                                                 *[Max. Marks :50*

*Instructions to the candidates:*

1) *Neat diagram must be drawn wherever necessary.*
2) *Figure to the right indicates full marks.*
3) *Assume suitable data wherever necessary.*
4) *Use of electronic pocket calculator is allowed (non-programmable).*

**Q1)** a) Define surveying, write down classification of surveying and its two applications. **[4]**

b) What is meant by Pre-Stressed Concrete (PSC)? Briefly explain with labelled proportionate sketch. State two primary types of PSC. **[4]**

c) Differentiate between Roadways and Railways. Support your answer with minimum 04 points. **[4]**

OR

**Q2)** a) Explain the importance of Quantity surveying. Support your answer with minimum 04 points. **[4]**

b) Briefly explain four tests for ascertaining quality of brick on the site. **[4]**

c) State whether following statements are 'True' or False', giving appropriate reasoning for your answer: **[4]**

i) 43 Grade Cement means a cement with minimum tensile strength of 43 N/mm$^2$,

ii) Compaction of concrete is an important step to avoid honey combing.

*Q3)* a) Describe and draw the level field book, and explain how the field notes are booked. How is the accuracy of the reduction of levels checked?**[6]**

b) Explain Matrix method of carrying out EIA. **[3]**

c) Define Reduced level and what are the methods of reduction of levels? Explain in brief. **[3]**

OR

*Q4)* a) Explain in brief recycling, reuse and recovery as E waste management option. **[3]**

b) Define surveying. Explain in brief the principal of working from whole to part. **[3]**

c) During fly levelling work, the staff reading were obtained at a regular interval of 25 mts. The readings were as under: B. S. - 0.545, 0.995, 2.705, 2.350. F.S. - 1.670, 1,350, 2.125, 3.450. The work was started from a point whose R.L. was known to be 250.000m. Enter the readings for Rise and Fall method to determine the R.L.'s of all stations. Also find the nature and magnitude of gradient. Apply usual checks. **[6]**

*Q5)* a) A plot owner has purchased a rectangular plot whose perimeter is 140 m and breadth is 30 m. He wants to construct a G + 1 storeyed bungalow. If permissible FSI is 1.2 calculate the possible construction on ground as well as 1st floor. Take front margin as 3 m and all other margins as 2m, with small side facing the road. **[7]**

b) "Sanitation is the important principle of planning" comment in detail on this statement, with neat sketch. **[6]**

OR

*Q6)* a) A plot having size of 35 m x 40 m. It is proposed to construct a G + 2 storeyed building with 600 sq m built up area on each ground and 1st floor. If permissible FSI is 1.2, how much is the permissible built up area on 2nd floor?

For the above plot, if all margines are 2m each, find maximum ground coverage. **[6]**

b) Enlist 10 principles of planning. Explain any 01 in brief. **[7]**

*Q7)* a) Explain in brief any 03 sources of noise and 03 effects of noise. **[6]**

b) Defien air pollution. Explain in brief any 02 effects of air pollution. **[3]**

c) Explain in brief: what is air pollution. Explain in brief any 03 effects of air pollution. **[4]**

OR

*Q8)* a) Explain in brief urbanization as reason for environmental pollution. **[3]**

b) Write short notes on: **[6]**

- Acid Rain

- Ozone Depletion

c) Explain with suitable examples conventional & non conventional energy sources in brief. **[4]**

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## [5351] - 103

## F.E. Engineering

## ENGINEERING GRAPHICS - I

## (2015 Pattern) (Semester - I)

*Time : 2 Hours]*                                                                 *[Max. Marks :50*

*Instructions to the candidates:*

1) *Retain all construction lines.*

2) *Figure to the right indicates full marks.*

3) *Assume suitable data wherever necessary.*

4) *Use of electronic pocket calculator is allowed (non-progammable).*

**Q1)** A line AB resting in the first quadrant has it's end A is 30 mm from the H.P. and in the V.P. End B is at 30 mm in-front of V.P. Draw projections of the line if , its elevation makes 39º inclination to H.P. plan makes 30º inclination to V.P. Draw its projections and locate the traces. **[12]**

OR

**Q2)** A hexagonal plate ABCDEF of 35 mm size is resting on its corner F on the H.P. Draw projections of the plate when the plate surface makes an angle of 35º to H.P. and plan of the FC makes 40º inclination to V.P. **[12]**

**Q3)** A hexagonal pyramind of base 35 mm and height 85 mm is resting on one of its base corners. The slant edge passing through resting corner makes 35º inclination to H.P. Draw projections of the pyramid when the plan of axis makes 40º inclination to V.P. **[13]**

OR

**Q4)** a) Draw a conic section when eccentricity ration is one. The distance between fixed line and focus is 50 mm; Name the curve and give all necessary dimensions. **[7]**

*P.T.O.*

b) Draw the development of lateral surface of hexagonal prism of base side 25 mm and axis height 65 mm. **[6]**

**Q5)** For the pictorial view shown in the Figure draw, **[13]**

    a) Sectional Front view in the direction X (along section AA)

    b) Top view

    c) Right hand side view

    Place all necessary dimensions. Use first angle method of projections.
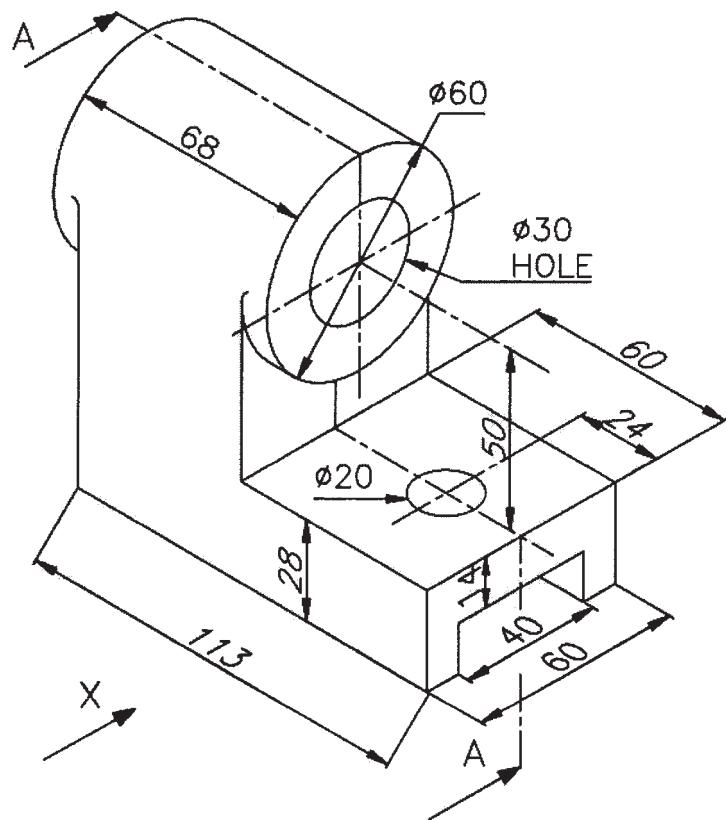


OR

**Q6)** For the pictorial view shown in the Figure draw, **[13]**

    a) Sectional front view along the section AA

    b) Top view

    c) Left hand side view

Place all necessary dimensions. Use first angle method of projections.
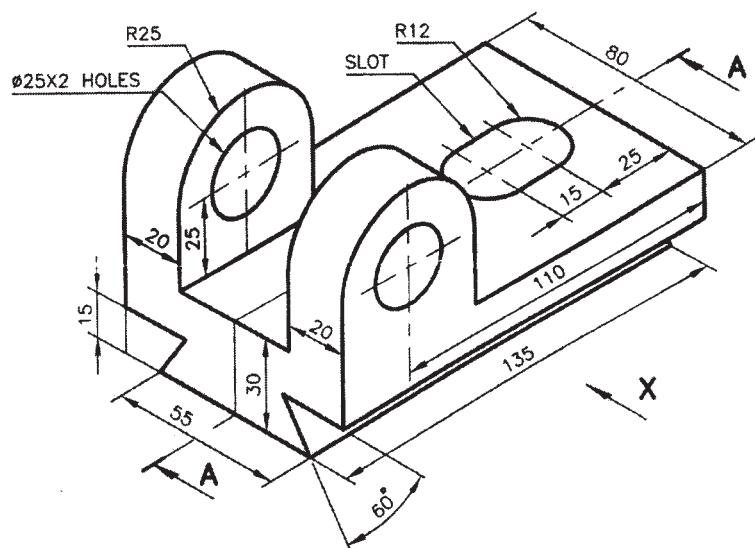


**Q7)** Figure shows front view and top view of an object. Draw Isometric view and show overall dimensions. **[12]**
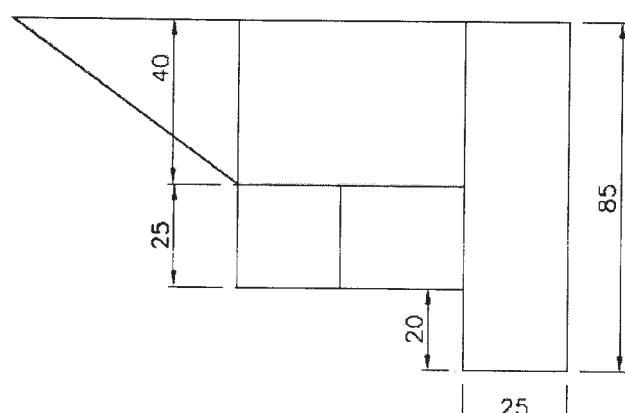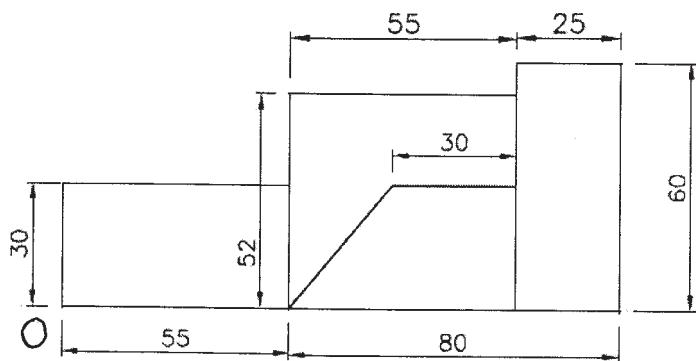


FRONT VIEW



TOP VIEW

OR

*Q8)* Figure shows front view and top view of an object. Draw Isometric view and show overall dimensions. **[12]**



FRONT VIEW



TOP VIEW

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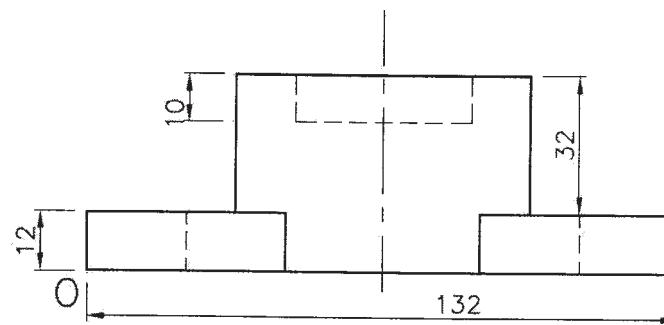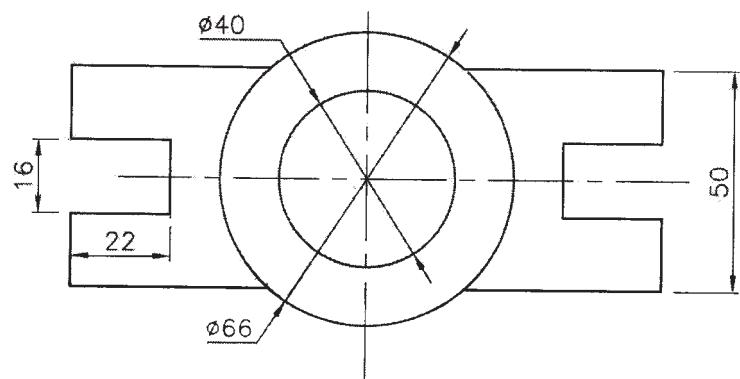
## [5351] - 104
## F.E.
# ENGINEERING PHYSICS
## (2015 Pattern) (Semester - I & II)

*Time : 2 Hours]*

*[Max. Marks :50*

*Instructions to candidates:*

1) *Neat diagram must be drawn wherever necessary.*
2) *Figure to the right indicate full marks*
3) *"Use of logarithmic table, slide rule, mollier charts, Electronics Calculator, and steam table is allowed".*
4) *"Assume suitable data, if necessary"*

**Q1)** a) How are Newton's Rings experimentally obtained? Derive an expression for the diameter of bright rings in reflected system and show that it is proportional to the square root of an odd natural number. **[6]**

b) Find the half angular width of the central maxima in the Fraunhofer diffraction pattern due to a single slit having a width of $7.07 \times 10^{-5}$cm, when illuminated by light having wavelength 5000 AU. **[3]**

c) Find the echo time of ultrasonics pulse which is travelling with the velocity $3.1 \times 10^3$ m/s in mild steel. The correct thickness measured by gauss meter is 9mm. **[3]**

OR

**Q2)** a) What is revereberation? Give Sabine's formula for reberation time. What are the factors affecting reberberation time? Explain how it can be optimized by controling these factors. **[6]**

b) Calculate the natural frequency of vibrations for a quartz plate of thickness 5.5 mm. ($Y = 8 \times 10^{10}$ N/m$^2$ and $\rho = 2650$ kg/m$^3$) **[3]**

c) Explain with a suitable diagram how the principle of interference is used in an anti-reflection coating. Derive an expression for its thickness. **[3]**

*Q3)* a) State the phenomena of double refraction. Hence explain Huygen's theory of double refraction. **[6]**

b) State the characteristics of laser beam and explain any one of them in brief **[3]**

c) What is Fermi Dirac probability distribution function? Give the meaning of all terms in it. **[3]**

OR

*Q4)* a) What is photovoltaic effect? Explain the construction and working of solar cell. Also draw the IV characteristics of solar cell & define fill factor **[6]**

b) Calculate the number of acceptors to be added in germanium sample to obtain the resistivity of 20 $\Omega$cm. Given:- $\mu_h$ = 1700 cm²/V.sec, e = $1.6 \times 10^{-19}$C **[3]**

c) What is difference between normal photography and holography? which property of lasers is most useful to record a hologram? **[3]**

*Q5)* a) State and explain Heisenberg's uncertainty principle. Illustrate it by an experiment of diffraction at a single slit **[6]**

b) State de-Broglie hypothesis of matter waves. Derive the expression for matter waves for an accelerating particle in terms of its kinetic energy.**[4]**

c) Calculate the first energy eigen value of electron in eV trapped in rigid box of length 1 AU. (e = $1.6 \times 10^{-19}$ C, h = $6.63 \times 10^{-34}$ J-sec, $m_e$ = $9.1 \times 10^{-31}$ kg) **[3]**

OR

*Q6)* a) Derive equation of energy when a particle is confined to an infinite potential well. Draw first three energy levels for an electron confined in it. **[6]**

b) Explain wave-function $\psi$. Give the physical significance of $\left|\Psi^2\right|$. **[4]**

c) A proton and an alpha particle are accelerated by the same potential difference. Find the ratio of their de-Broglie wavelength. ($m_\alpha = 6.68\ 0^{-27}$ kg, charge on alpha particle $= 2 \times$ Charge on electron, $m_p = 1.673 \times 10^{-27}$ kg) **[3]**

*Q7)* a) What is superconductivity? Explain BCS theory of superconductors. **[6]**

b) Explain the mechanical method, high energy ball milling to synthesize nanoparticles with the help of a neat and suitable diagram **[4]**

c) The critical temperature for lead is 7.2K. However at 5K it loses its superconductivity when subjected to a magnetic field of $3.3 \times 10^4$ A/m. Find the maximum value of critical magnetic field which will allow the metal to retain its superconductivity at 0K. **[3]**

OR

*Q8)* a) Explain the optical and electrical properties of nanoparticles. **[6]**

b) Give any four points to distinguish between Type I & Type II superconductors **[4]**

c) List the applications of nanotechnology in the field of automobile. Explain any one application in brief **[3]**

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**F.E.**

**BASIC ELECTRICAL ENGINEERING**

**(2015 Pattern) (Semester - II)**

*Time : 2 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

1) *Neat diagrams must be drawn wherever necessary.*

2) *Figure to the right indicates full marks.*

3) *Assume suitable data wherever necessary.*

4) *Use of electronic pocket calculator is allowed (non-programmable).*

*Q1)* a) Describe with necessary graph, the effect of temperature on resistance of following material. **[7]**

     a) Metals

     b) Insulation.

   b) An air cored toroid having 25 cm mean diameter & 6.26 cm$^2$ circular cross sectional area would uniformly with 1000 turns of wire. Determine **[6]**

     i) Inductance of toroid

     ii) emf induced in the coil when current is increasing at the rate of 200 A/sec.

     iii) energy stored in its magnetic field when coil carries current of 10 A.

OR

*Q2)* a) In a hydro electric generating station, the head of water is 425m. If 1250 liters of water are required to generate 1 kWh of electric energy, find the overall efficiency. Assume 1 liter = 1 kg. **[7]**

*P.T.O.*

b)  Derive the formula of total reluctance and total mmf in following circuit if relative permeability are $\mu_{r1}$ and $\mu_{r2}$ respectively. **[6]**
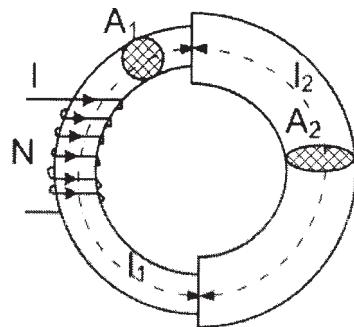


Q3) a)  Give the types of capacitors based on dielectric material used and describe any two types. **[6]**

b)  A sinusoidal varying alternating current has r.m.s. value of 40 A and periodic time of 20 milliseconds. If the waveform of this current enters in to positive half cycle at t = 0, find instantaneous values of the current at quarter cycle, t1 = 7 ms and t2 = 14ms. **[6]**

OR

Q4) a)  A 50 kVA single phase transformer has a turns ratio of 300/20. The primary winding is connected to a 2200V, 50Hz supply. Calculate. **[6]**

   i)   The secondary voltage at no load.

   ii)  The approximate value of Primary current on full load.

   iii) The approximate value of secondary current on full load.

b)  Explain the concept of lagging, leading and in phase Phasors. Draw the respective waveform and Phasor diagram for the same. **[6]**

Q5) a)  Derive the expression for current drawn and power consumed by a circuit consisting of a resistor R and a capacitor C connected in series across $v = V_m \sin(\omega t)$. **[6]**

b)  Each phase of star connected load has an impedance (25+j40) connected across 3-phase, 415 V, 50 Hz supply. Determine:

   a)   Line current

   b)   Active, Reactive and Apparent Power. **[7]**

OR

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*Q6)* a) Derive the relationship between the line and phase value of voltage and current for balanced three phase star connected resistive load with the help of connection diagram and phasor diagram. Hence obtain the total power consumed. **[6]**

b) Two impedances $Z_1 = 30 \angle 45° \, \Omega$ and $Z_2 = 45 \angle 30° \, \Omega$ are connected in parallel across a single phases 230 V, 50 Hz supply. Calculate the **[7]**

    i) current drawn,

    ii) power factor and

    iii) power consumed by the circuit.

*Q7)* a) With usual notation, derive step by step formula for converting star elements of the network to delta elements on equivalence basis. **[6]**

b) Calculate the current through all resistance using superposition principle. **[6]**
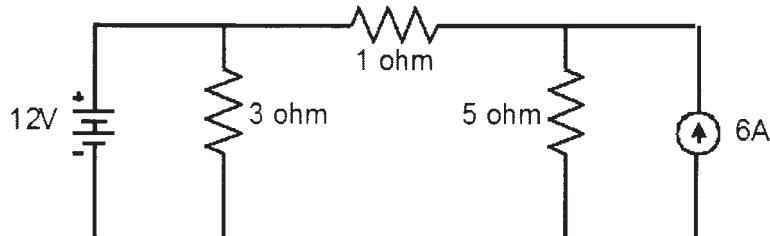


OR

*Q8)* a) Elaborate steps to be followed to obtain current through any branch using Superposition theorem. **[6]**

b) Determine effective resistance between A and B. **[6]**



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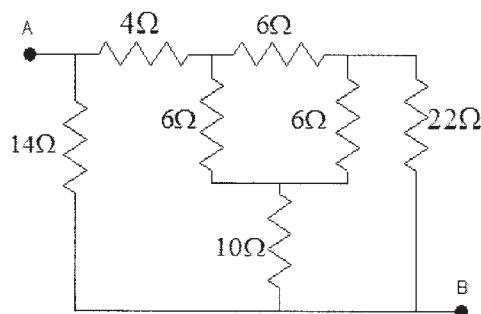
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# F.E.
# BASIC ELECTRONICS ENGINEERING
## (2015 Pattern) (Semester - I & II)

*Time : 2 Hours]*                                                                                    *[Max. Marks : 50*

***Instructions to the candidates:***
  *1)   Figures to the right indicate full marks.*
  *2)   Neat diagrams must be drawn wherever necessary.*
  *3)   Assume suitable data, if necessary.*

**Q1)** a)   Define rectifier circuit and mention its types. Draw and explain any one with waveforms. **[6]**

   b)   Draw a circuit diagram of CE amplifier. State the function of each component in the circuit. **[6]**

<div align="center">OR</div>

**Q2)** a)   Explain construction of Enhancement type N-channel MOSFET. **[6]**

   b)   Draw and explain Voltage Multiplier circuit. **[6]**

**Q3)** a)   Find output voltage of op-amp circuit shown in fig. below, **[6]**
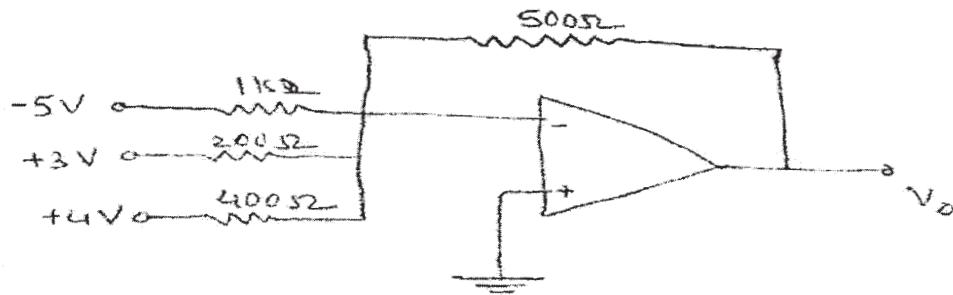


   b)   Draw 2 input Ex-OR gate, write logic equation and implement using basic logic gates. **[6]**

<div align="center">OR</div>

**Q4)** a)   Draw and explain circuit diagram of Astable Multivibrator using IC 555. Write equation for frequency of oscillations. **[6]**

   b)   Draw block diagram of Microprocessor and Microcontroller. **[6]**

<div align="right">*P.T.O.*</div>

*Q5)* a) Draw and explain block diagram of Digital Thermometer. Mention two applications. **[7]**

b) Compare active and passive transducers. **[6]**

OR

*Q6)* a) Explain in detail : **[7]**

    i) Construction of DIAC.

    ii) Characteristics of DIAC.

    iii) Modes of operation

b) Explain in detail, the selection criteria for transducer. **[6]**

*Q7)* a) Explain the elements of communication system with the help of block diagram. **[7]**

b) Write a note on co-axial cable and optical fiber cable with neat structural diagram. **[6]**

OR

*Q8)* a) Explain the basic structure of mobile phone system. **[6]**

b) A carrier signal $20\sin(2\pi \times 104t)$ is used to modulating signal $10 \sin (2\pi \times 103t)$. Determine the modulation index for the modulated wave and draw the frequency spectrum for AM wave. **[7]**

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**F.Y.**

**ENGINEERING**

**Engineering Mathematics - II**

**(2015 Pattern)** (Semester - II)

*Time : 2 Hours]*          *[Max. Marks :50*

***Instructions to the candidates:***

    *1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*

    *2) Neat diagram must be drawn wherever necessary.*

    *3) Figure to the right indicates full marks.*

    *4) "Assume suitable data, if necessary and clearly state."*

    *5) Use of electronic pocket calculator is allowed.*

**Q1)** a)    Solve the following.

     i)    Solve the following differential equation $\left(4+e^{2x}\right)\dfrac{dy}{dx} = ye^{2x}$.    **[4]**

     ii)    Solve, $x(x-y)\dfrac{dy}{dx} = y(x+y)$.    **[4]**

   b)    A steam pipe 40cm in diameter contains steam at $150^0$C and is protected with a covering 10cm. thick for which k=0.0012, If the temperature of the outer surface of the covering is $30^0$C, find the temperature at a distance 25cm from the center of the pipe under steady-state condition.    **[4]**

OR

**Q2)** a)    Solve $\cos x \dfrac{dy}{dx} + y = \sin x$.    **[4]**

   b)    i)    A body at temperature $100^0$C is placed in a room whose temperature is $25^0$C and cools to $80^0$C in 10 minutes. Find the time when the temperature will be $60^0$C.    **[4]**

       ii)    a resistance of 150 ohms and an inductance of 0.3 H are connected in series with a battery of 25 volts. Find the current in the circuit if i=0 at t=0.    **[4]**

*P.T.O.*

*Q3)* a) Obtain Fourier series expansion for $f(x) = x^2$ in the interval $-1 < x < 1$,
$f(x+2l) = f(x), \forall x$. **[5]**

b) Evaluate $\int_0^\infty x^7 e^{-2x^2} dx$. **[3]**

c) Solve any one.

   i) Trace the curve $r = a\cos 2\theta$ **[4]**

   ii) Trace the curve $xy^2 = a^2(a-x)$ **[4]**

OR

*Q4)* a) If $u_n = \int_0^{\pi/4} \tan^n \theta d\theta$ then show that $n(U_{n+1} + U_{n-1}) = 1$. **[4]**

b) If $f(x) = \int_a^x (x-t)^2 G(t)$ at, then. **[5]**

   show that $\dfrac{d^3 f}{dx^3} - 2G(x) = 0$.

c) Find the primeter of the cordioide $r = a(1+\cos\theta)$ from $\theta = 0$ to $\theta = \dfrac{\pi}{3}$.**[4]**

*Q5)* a) Find the equation of the sphere for which the circle
$x^2 + y^2 + z^2 + 7y - 2z + 2 = 0$, $2x + 3y + 4z = 8$ is a great circle. **[5]**

b) Find the equation of right circular cone whose vertex is (1,1,1), axis the

   line $\dfrac{x-1}{1} = \dfrac{y-1}{2} = \dfrac{z-1}{3}$ and semi vertical angle $\dfrac{\pi}{4}$. **[4]**

c) Find the equation of a right circular cylinder having its radius as 03 units

   and equation of whose axis is $\dfrac{x-1}{2} = \dfrac{y+1}{-1} = \dfrac{z-2}{3}$. **[4]**

OR

*Q6)* a) Find the sphere through the circle $x^2 + y^2 + z^2 = 4, z = 0$ meeting the plane $x + 2y + 2z = 0$ in a circle of radius 3. **[5]**

b) Find the equation of the right circular of the cone with vertex (-1,0,0), semi vertical angle $60^0$ and axis is x - axis. **[4]**

c) Find the equation of a right circular cylinder having its radius as 04 units and equation of whose axis is $\dfrac{x+1}{1} = \dfrac{y+1}{-1} = \dfrac{z+1}{1}$. **[4]**

*Q7)* Attempt any two of following

a) Change the order of integration $\displaystyle\int_0^a \int^{y+a} \dfrac{f(x,y)}{a^2 - y^2} dxdy$ ? **[7]**

b) Find the volume of tetrahedron bounded by the co-ordinate planes and the plane $\dfrac{x}{2} + \dfrac{y}{3} + \dfrac{z}{4} = 1$ ? **[6]**

c) Find moment of inertia of the portion of the parabola $y^2 = 4ax$, bounded by $x - axis$ and latus rectum, about $x - axis$, if density at each point varies as the cube of the abscissa? **[6]**

<div align="center">OR</div>

*Q8)* Attempt any two of following

a) Evaluate $\displaystyle\iint_R x^2 y^2 dxdy$ over the positive quadrant of $x^2 + y^2 = 1$? **[7]**

b) Evaluate $\displaystyle\iiint \dfrac{dxdydz}{\sqrt{1 - x^2 - y^2 - z^2}}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$ in positive octant? **[6]**

c) ABCD is a square plate of side a and 0 is the mid point of AB. If the surface density various as the square of distance from 0, show that the center of gravity of the plate is at a distance $\dfrac{7a}{10}$ form 0? **[6]**

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# ENGINEERING

## Engineering Mechanics

### (2015 Pattern) (Semester - II)

*Time : 2 Hours]*          *[Max. Marks :50*

*Instructions to the candidates:*

   *1)*    *Attempt Q.1 or Q.2,  Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*

   *2)*    *Neat diagram must be drawn wherever necessary.*

   *3)*    *Figure to the right indicates full marks.*

   *4)*    *"Assume suitable data, if necessary and clearly state."*

   *5)*    *Use of nonprogrammable electronic pocket calculator is allowed.*

*Q1)* a)    The lever ABC fixed at A shown in Figure is subjected to a 200 N force at C at $\theta = 30^0$. Find the moment of this force about A. Also find the value of $\theta$ for which the moment about A is Zero.     **[6]**
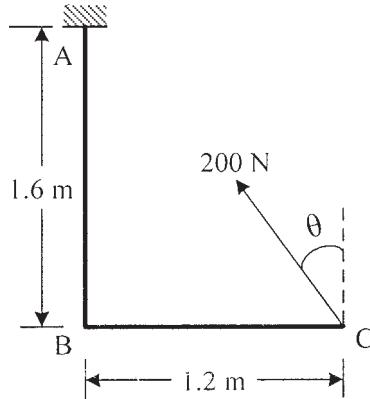


   b)    The motion of particle is defined by, $x = t^3-6t^2+9t+5$, where x expressed in meter and t in seconds. Determine the time at which velocity becomes Zero. Also determine velocity and acceleration at $t = 5$s.     **[6]**

**OR**

*Q2)* a) Locate the centroid of the plane area as shown in Figure with respect to origin O. **[6]**
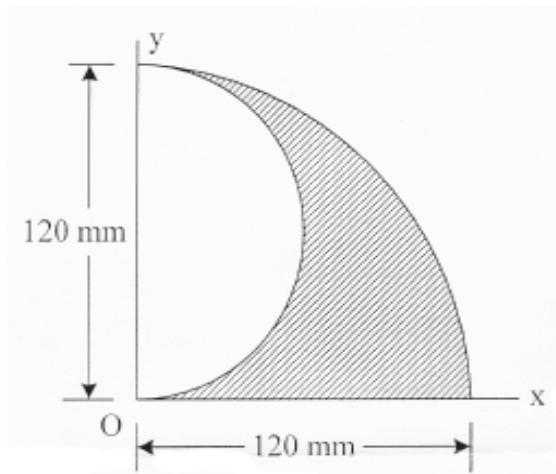


b) The 10kg block is subjected to the force shown in Figure determine its velocity when t = 2s if v = 0 when t = 0. **[6]**



$F = (20\ t)\ N$ — Block of 10 kg
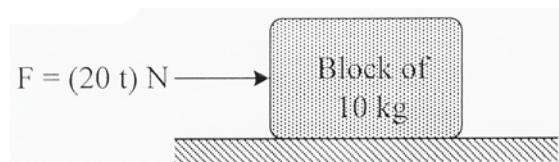
*Q3)* a) A motorist is traveling on a curved section of highway of radius 762m at the speed of 96 kmph. The motorist suddenly applies the brakes, causing the automobile to slow down at a constant rate. Knowing that after 8s the speed has been reduced to 72 kmph, determine the acceleration of the automobile immediately after the brakes have been applied. **[6]**

b) The 2kg pendulum bob is released from rest when it is at A as shown in Figure. Determine the speed of the bob when it passes through its lowest position B. **[6]**
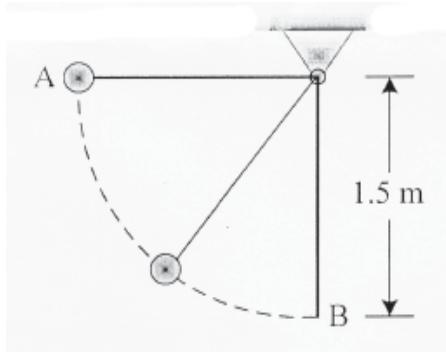
**OR**

*Q4)* a) If the 10kg ball has a velocity of 3 m/s when it is at the position A as shown in Figure along the vertical path, determine the tension in the cord and the tangential component of acceleration of ball at this position. **[6]**
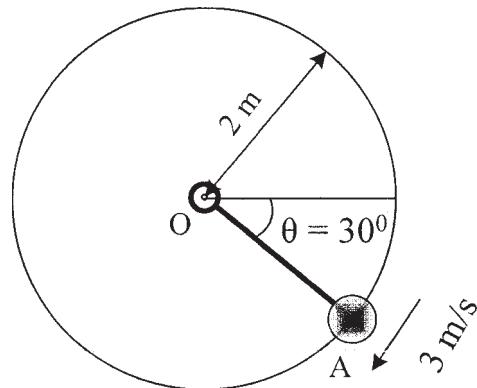


b) Determine the coefficient of restitution e between two identical balls A and B. The velocities of balls A and B before and after impact are shown in Figure. **[6]**



**[5351] - 109**                           3
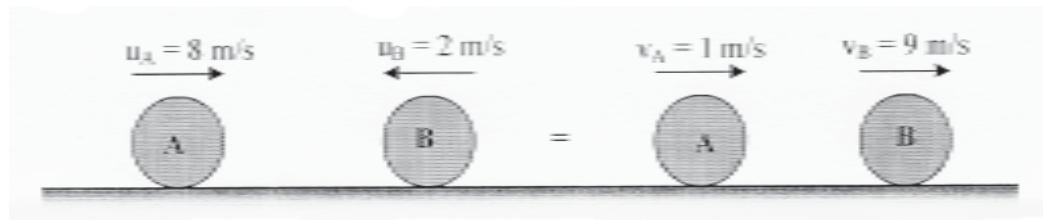
*Q5)* a)  Determine the tension developed in wires CA and CB required for equilibrium of the 10kg cylinder as shown in Figure.  **[6]**
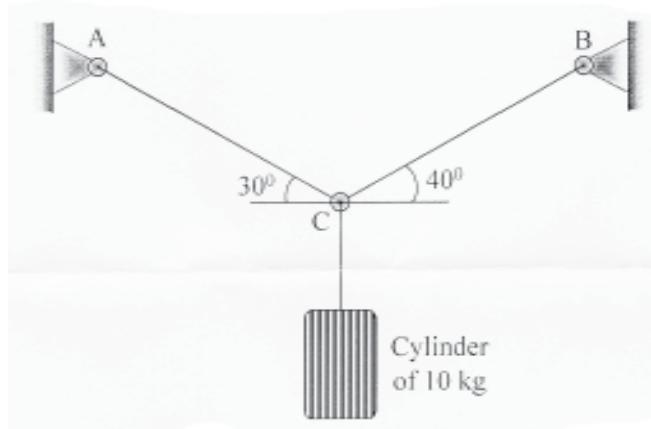


b)  The 10kg lamp shown in Figure is suspended from three equal length cords. Determine its smallest vertical distance s from the ceiling if the force developed in any cord is not allowed to exceed 50N.  **[7]**
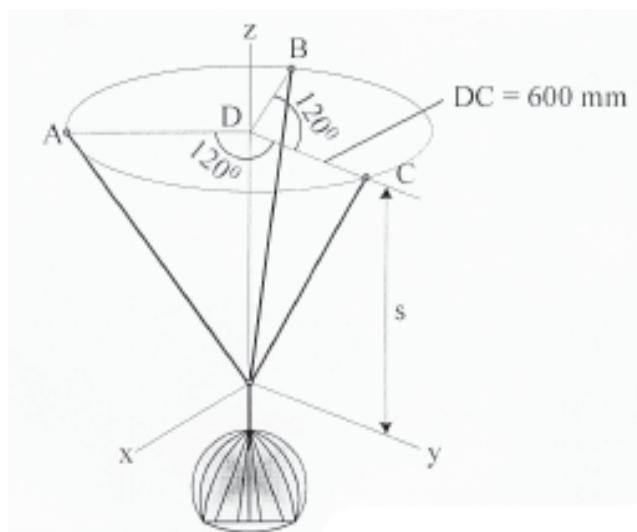


**OR**

*Q6)* a) Determine the horizontal and vertical components of reaction at the supports for the beam as shown in Figure. **[7]**
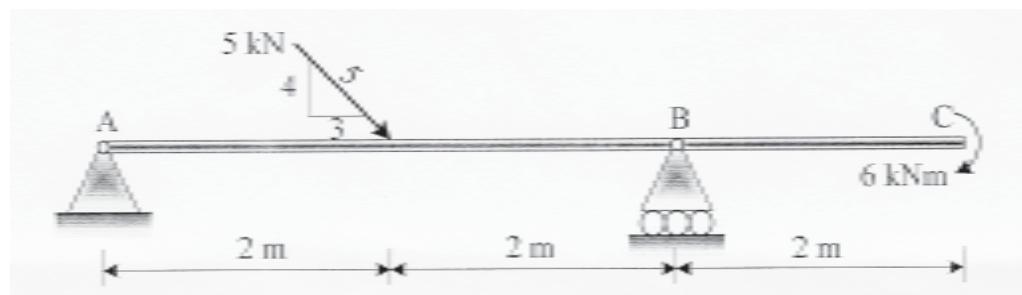


b) The building slab is subjected to four parallel column loading shown in Figure. Determine F1 and F2 if the resultant force acts through point (12m, 10m). **[6]**
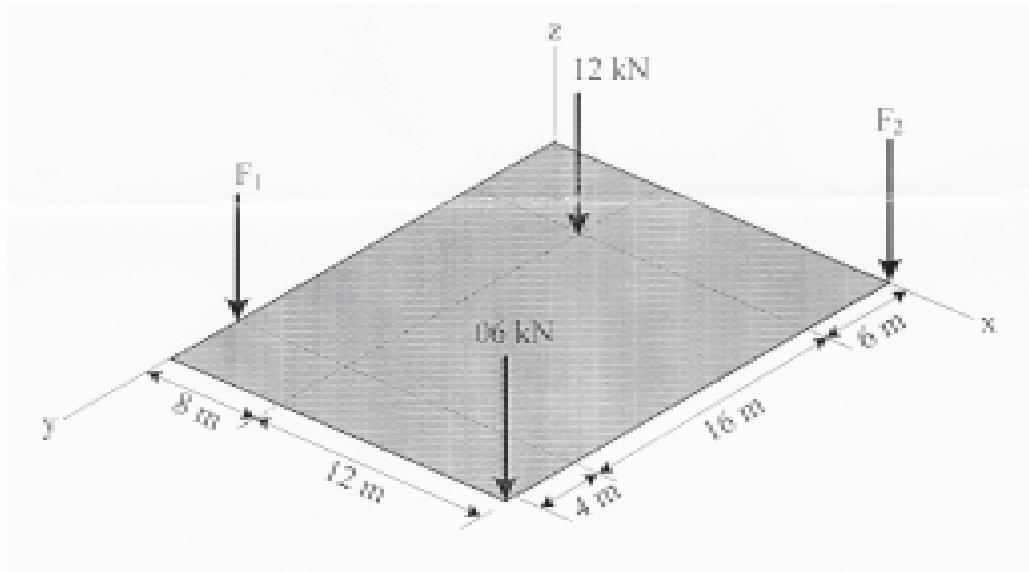
**Q7) a)** Determine the forces in each member of the truss shown in Figure. State if the members are in tension or compression. **[6]**
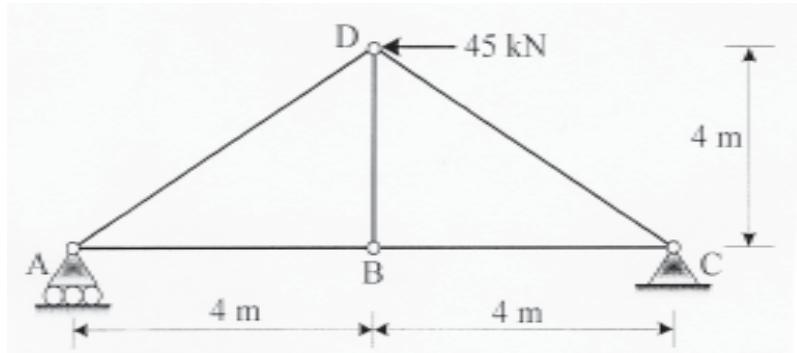


**b)** The pipe of weight W is to be pulled up the inclined plane of slope $\alpha$ using a force P shown in Figure. If P acts at an angle $\phi$, show that for limiting condition $P = \sin(\alpha + \phi) / \cos(\phi - \theta)$ where $\theta$ is the angle of static friction $\theta = \tan^{-1} \mu_s$. **[7]**
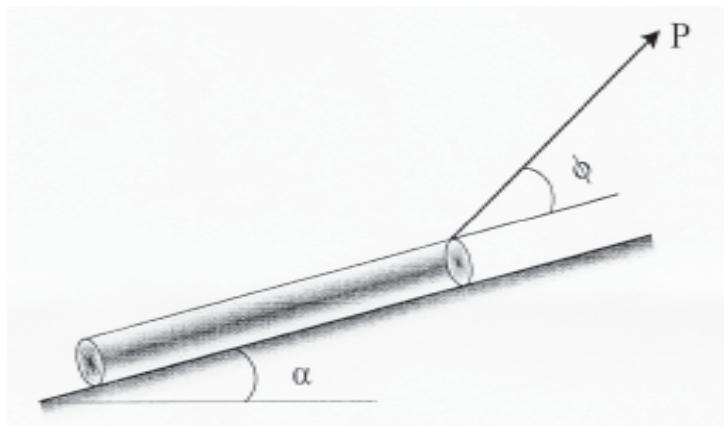


**OR**

*Q8)* a) For the cable AB as shown in Figure, find the reaction at supports and tension in each segment. **[7]**
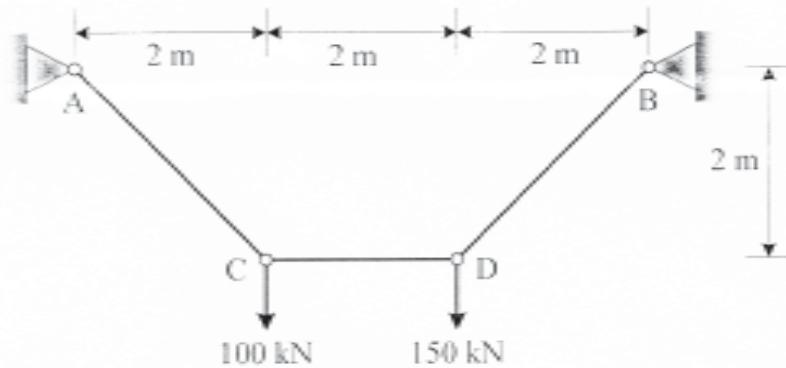


b) Determine the maximum horizontal force P that can be applied to the 12kg hoop without causing it to rotate as shown in Figure. The coefficient of static friction between the hoop and the surfaces at A and B is, $\mu_s = 0.2$ Take r = 300mm. **[6]**



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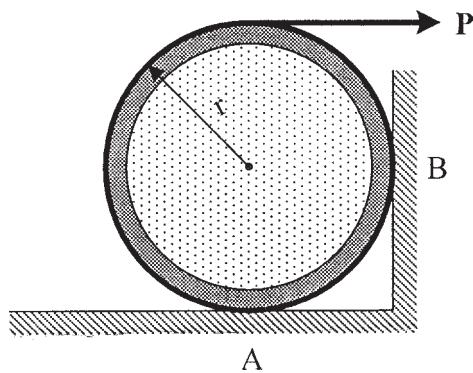
### [5351] - 110

### F. E.

# BASIC MECHANICAL ENGINEERING

## (2015 Pattern) (Semester - I & II)

*Time : 2 Hours]*                                                                 *[Max. Marks :50*

***Instructions to the candidates:***

1) *Figures to the right indicates full marks.*

2) *Use of electronic pocket calculator is permitted.*

3) *Use of cell phone is prohibited in the examination hall.*

4) *Neat diagrams must be drawn whernever necessary.*

5) *"Assume suitable data, if necessary and clearly state."*

6) *"Attempt Q.1 or Q.2, Q.3 or Q.4 Q.5 or Q.6 and Q.7 or Q.8".*


**Q1)** a)  Explain construction and working of rigid flange coupling with neat sketch.
                                                                                              **[6]**

     b)  Compare mechanism and machine (3 points). Draw a sketch of four bar
         mechanism. State its application.                                       **[6]**


### OR

**Q2)** a)  Compare belt drive, chain drive and gear drive. (6 points)          **[6]**

     b)  Classify engineering materials. State 2-3 important properties and 2-3
         engineering application of high carbon steel and aluminium.            **[6]**


**Q3)** a)  What is welding? Draw neat sketch of arc welding and brazing process
         setup.                                                                  **[7]**

     b)  Explain reaming, counter sinking, tapping operation performed on radial
         drilling machine.                                                       **[6]**

### OR

*Q4)* a)  Differentiate between arc welding, brazing and soldering process. (6 points). **[6]**

b)  Explain drilling, reaming, boring, tapping operation performed on radial drilling machine. **[7]**

*Q5)* a)  What is thermodynamic system? Explain various types of thermodynamic systems with example. **[4]**

b)  Define atmospheric pressure. What is difference between gauge pressure and absolute pressure? Draw a sketch/ diagram which represents relation between them. **[4]**

c)  A heat pump is used to maintain the house at 25 °C. The house is losing the heat at the rate of 60,000 kJ/hr to the surrounding. While the heat generated in the house by various appliances is 4,000 kJ/hr. If COP of heat pump is 1.5. Find the power required to drive the heat pump. Define heat pump and draw its sketch. **[5]**

OR

*Q6)* a)  State any two statements and discuss any two limitations of first law of thermodynamics. **[4]**

b)  Define & explain the following devices with sketch: Heat engine and Refrigerator. **[4]**

c)  The pressure of kerosene flowing through a pipe is to be measured with simple U-tube mercury manometer. Left arm of U tube is connected to pipe while right arm of the U tube is open to atmosphere. Calculate **[5]**

  i)  Absolute pressure of the kerosene in pipeline and

  ii)  Kerosene level in left arm of manometer above datum. Draw the sketch of the setup. Given : Atmospheric Pressure =10m of water columnmercury level in right-arm of manometer above datum = 20 cm Gauge Pressure of kerosene = 22 kPa Specific gravity of the kerosene = 0.8 Density of mercury = 13600 kg/m³ Acceleration due to gravity, g = 9.81 m/s².

*Q7)* a) What are the types of energy resources? Draw block diagram of wind power plant. Explain energy extraction (transfer) in the plant. **[6]**

b) Explain working of reciprocating pump with the help of sketch. **[6]**

OR

*Q8)* a) Explain working of window air conditioner with neat sketch. Why smoking is prohibited in the air conditioned room/ office. **[6]**

b) Explain working principle of reaction steam turbine with simple sketch.**[6]**

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