Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4956]-101

F.E. (Common) EXAMINATION, 2016

ENGINEERING MATHEMATICS—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

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

(*v*) Assume suitable data, if necessary.

1. (*a*) Show that the system

$$3x + 4y + 5z = \alpha,$$
$$4x + 5y + 6z = \beta,$$
$$5x + 6y + 7z = \gamma$$

is consistent only when $2\beta = \alpha + \gamma$. [4]

(*b*) Find eigen values and eigen vector corresponding to lowest eigen value for the matrix. [4]

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

P.T.O.

(*c*) If [4]

$$\operatorname{cosec}\left(\frac{\pi}{4} + ix\right) = u + iv$$

where x, u, v are real, show that

$$(u^2 + v^2)^2 = 2(u^2 - v^2)$$

Or

2. (*a*) Examine for linear dependence of vectors [4]

(1, 2, –1, 0), (1, 3, 1, 2), (4, 2, 1, 0), (6, 1, 0, 1).

(*b*) Show that [4]

$$\left|\frac{z}{|z|} - 1\right| \leq |\arg z|$$

(*c*) Prove that i^i is wholly real and find its principal value. [4]

3. (*a*) Test the convergence of the series (any *one*) [4]

(*i*) $1 + \frac{3}{2!} + \frac{3^2}{3!} + \frac{3^3}{4!} + \frac{3^4}{5!} + \ldots\ldots\ldots\ldots$.

(*ii*) $\sum \frac{1}{n} \cos\left(\frac{1}{n}\right)$

(*b*) Expand

$$\sin^{-1}\left(\frac{2x}{1 + x^2}\right)$$

in ascending powers of x [4]

(*c*) Find the n^{th} derivative of [4]

$$\frac{1}{(x-1)^2(x-2)}.$$

Or

4. (*a*) Solve any *one* : [4]

(*i*) $\lim_{x \to 0} (1 + \tan x)^{\cot(x)}$

(*ii*) Find the values of a and b such that

$$\lim_{x \to 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1.$$

(*b*) Using Taylor's theorem expand [4]

$$x^4 - 3x^3 + 2x^2 - x + 1$$

in powers of $(x - 3)$

(*c*) If

$$y = (\sin^{-1} x)^2,$$

prove that [4]

$$(1 - x^2)y_{n+2} - (2n + 1)x\, y_{n+1} - n^2 y_n = 0.$$

5. Solve any *two* questions :

(*a*) If [6]

$$u = \log (x^3 + y^3 + z^3 - 3xyz),$$

prove that

$$\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = -\frac{9}{(x + y + z)^2}.$$

(*b*) If [7]

$$z = x^8 f\left(\frac{y}{x}\right) + y^{-8}\ \phi\left(\frac{x}{y}\right),$$

prove that

$$x^2\frac{\partial^2 z}{\partial x^2} + 2xy\frac{\partial^2 z}{\partial x \partial y} + y^2\frac{\partial^2 z}{\partial y^2} = 64z + 8y^{-8}\mathrm{Q}\left(\frac{x}{y}\right) - 8x^8 f\left(\frac{y}{x}\right)$$

(*c*) If [6]

$$u = f\ (2x - 3y,\ 3y - 4z,\ 4z - 2x),$$

then find value of

$$\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z}.$$

Or

6. Solve any *two* questions :

(*a*) If [6]

$$ux + vy = 0,\ \frac{u}{x} + \frac{v}{y} = 1$$

prove that

$$\left(\frac{\partial u}{\partial x}\right)_y - \left(\frac{\partial v}{\partial y}\right)_x = \frac{y^2 + x^2}{y^2 - x^2}.$$

(*b*) If [6]

$$u = \sec^{-1}\left[\frac{x + y}{\sqrt{x} + \sqrt{y}}\right],$$

prove that

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = -\frac{1}{4}\ \cot u\left[3 + \cot^2 u\right].$$

(*c*) If

$$\phi = f(x, y, z), \quad x = \sqrt{vw}, \quad y = \sqrt{uw}, \quad z = \sqrt{uv},$$

prove that :

$$x\frac{\partial \phi}{\partial x} + y\frac{\partial \phi}{\partial y} + z\frac{\partial \phi}{\partial z} = u\frac{\partial \phi}{\partial u} + v\frac{\partial \phi}{\partial v} + w\frac{\partial \phi}{\partial w}. \qquad [7]$$

7. (*a*) If

$$x = uv \text{ and } y = \frac{u + v}{u - v},$$

find $\frac{\partial(u, v)}{\partial(x, y)}$. [4]

(*b*) Find the percentage error in the area of an ellipse when an error of 1% each is made in measuring its semimajor and semiminor axes. [4]

(*c*) Find the extreme values of : [5]

$$f(x, y) = xy(a - x - y).$$

Or

8. (*a*) Examine whether the following functions are functionally dependent, if so find the relation betwen them [4]

$$u = \frac{x + y}{1 - xy}, \quad v = \tan^{-1} x + \tan^{-1} y.$$

(*b*) A balloon is in the form of right circular cylinder of radius 1.5 m and length 4 m and is surrounded by hemispherical ends. If the radius is increased by 0.01 m and the length by 0.05 m, find the percentage change in the volume of a balloon. [4]

(*c*) As the dimensions of a triangle ABC are varied, show that the maximum value of cosA cosB cosC is obtained when the triangle is equilateral. [5]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4956]-102

F.E. EXAMINATION, 2016

ENGINEERING PHYSICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data, if necessary.

(*v*) *All* questions are compulsory.

Constants :— (*i*) Mass of electron = $m_e = 9.1 \times 10^{-31}$ kg

(*ii*) Charge on electron = $e = 1.9 \times 10^{-19}$ C

(*iii*) Mass of proton = $m_p = 1.673 \times 10^{-27}$ kg

(*iv*) Mass of neurton = $m_n = 1.675 \times 10^{-27}$ kg

(*v*) Planck's constant = $h = 6.63 \times 10^{-34}$ J.s.

(*vi*) Velocity of light = $c = 3 \times 10^8$ m/s

1. (*a*) For a plane diffraction grating, starting from the equations of resultant amplitude and intensity, derive conditions for maxima and minima of the diffraction pattern. [6]

P.T.O.

(*b*) Explain how ultrasonic waves are used for detection of flaws in metal. [3]

(*c*) A hall of dimensions 20 m × 20 m × 20 m has a reverberation time of 1.2 sec. Find average absorption coefficient. [3]

Or

2. (*a*) What is magnetostriction effect ? Explain construction and working of magnetostriction oscillator. [6]

(*b*) Explain with suitable diagram how interference is used to design anti-reflection coating. [3]

(*c*) A parallel beam of light 622 nm incident on a glass plate of refractive index 1.5 such that angle of refraction into the plate is 60°. Calculate the smallest thickness of the plate which will appear dark by reflection. [3]

3. (*a*) What is double refraction ? Explain this phenomenon on the basis of Huygen's theory. [6]

(*b*) What is Fermi energy in semiconductor ? With the help of labeled diagram show the position of Fermi level in the case of a diode that is connected in forward bias. [3]

(*c*) Calculate the number of acceptor atoms that need to be doped in germanium sample to obtain the resistivity of 8 Ω cm. [Given : mobility μ = 1600 $cm^2/V.s$] [3]

Or

4. (*a*) Derive an expression for conductivity in case of intrinsic and extrinsic semiconductors. [6]

(*b*) What is stimulated emission of radiations ? Explain its significance in production of laser. [3]

(*c*) Explain any *one* engineering application of laser. [3]

5. (*a*) Deduce Schrödinger's time independent wave equation. [6]

(*b*) State and explain Heisenberg's uncertainty principle. [4]

(*c*) Calculate de Broglie wavelength for a proton moving with velocity 1 percent of velocity of light. [3]

Or

6. (*a*) Define phase velocity and group velocity. Show that group velocity is equal to particle velocity. [6]

(*b*) Explain why probability of finding of a particle cannot be predicted by the interpretation of wave function ψ. Explain physical significance of $|\psi|^2$. [4]

(*c*) A neutron is trapped in an infinite potential well of width 10^{-14} m. Calculate its first energy eigenvalue in eV. [3]

7. (*a*) Explain BCS theory of superconductivity. Mention why superconductivity is observed below critical temperature. [6]

(*b*) Explain any *one* method for synthesis of nano-particles. [4]

(*c*) Explain the applications of nano-particles in the field of automobiles. [3]

Or

8. (*a*) Why are the properties of nano-particles different from that of the bulk materials ? Explain any *two* properties of nano-particles. [6]

(*b*) Explain in brief : [4]

(*i*) Meissner effect

(*ii*) Critical magnetic field.

(*c*) Explain the applications of superconductors in the field of electronics. [3]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4956]-103

F.E. EXAMINATION, 2016

ENGINEERING CHEMISTRY

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Describe Demineralisation/Deionization method with figure, process, ion exchange and regeneration reactions for softening of hard water. [6]

(*b*) What is reference electrode ? Draw neat labelled diagram of glass electrode and give its representation. [3]

(*c*) Define the terms : [3]

(*i*) Resistance

(*ii*) Cell constant

(*iii*) Equivalent conductance.

P.T.O.

Or

2. (*a*) Explain principle, instrumentation and applications of UV visible spectrophotometer. [6]

(*b*) Explain any *three* principles of green chemistry. [3]

(*c*) An exhausted zeolite softener was regenerated by passing 150 litres of NaCl solution having strength 150 gms./lit. of NaCl. How many litres of hard water sample having hardness 400 ppm can be soften by using softener. [3]

3. (*a*) Give preparation, reaction, properties and applications of following : [6]

(*i*) Styrene-butadiene rubber

(*ii*) HDDE.

(*b*) What is power alcohol ? Give preparation with reaction and advantages of power alcohol. [3]

(*c*) Calculate carbon and hydrogen in coal sample from the following data : [3]

0.25 gm of coal sample on burning in combustion chamber in current of pure O_2, was found to increase weight of $CaCl_2$ U tube by 0.12 gm and KOH U tube by 0.57 gm.

Or

4. (*a*) Draw neat labelled diagram and give the construction working of Bomb calorimeter to determine GCV of a fuel. State formula with corrections to calculate GCV. [6]

(*b*) Explain bulk polymerisation technique. Draw the figure and state its disadvantages. [3]

(*c*) Distinguish between thermosoftening and thermosetting polymer with example. [3]

5. (*a*) Explain industrial production of hydrogen by steam reforming of methane and coke. [5]

(*b*) Give structure, one method of prepration and application of silane. [4]

(*c*) Explain the structure and properties of graphite. [4]

Or

6. (*a*) What are carbon nanotubes ? Give types with respect to their structure and its applications. [5]

(*b*) Discuss the properties of hydrogen which make it difficult for storage. [4]

(*c*) Explain the structure of Diamond, give its properties and applications. [4]

7. (*a*) Discuss any *five* factors affecting corrosion. [5]

(*b*) What is cathodic protection ? Explain any *one* mehod in detail. [4]

(*c*) Define electroplating ? Explain process with neat labelled diagram and its applications. [4]

Or

8. (*a*) Define Net corrosion. Explain corrosion by hydrogen evolution mechanism. [5]

(*b*) What is anodic and cathodic coating ? Which is more protective and why ? [4]

(*c*) What is Galvanising ? Explain process with neat labelled diagram to protect iron from corrosion. [4]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4956]-104

F.E. EXAMINATION, 2016

BASIC ELECTRICAL ENGINEERING

(2012 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is insulation resistance ? Obtain an expression for insulation resistance of single core cable. [6]

(*b*) If a coil of 150 turns is linked with a flux of 0.01 wb when carring a current of 10A, calculate

(*i*) Self inductance of the coil

(*ii*) If this current is uniformly reversed in 0.1 sec, calculate induced emf.

(*iii*) If a second coil of 100 turns is uniformly wound over the first coil, find mutual inductance between them. [6]

P.T.O.

Or

2. (*a*) Obtain the expression for co-efficient of coupling between two magnetically coupled coils. [6]

(*b*) Find the current flowing at the instant of switching 40 W Lamp on 240 V supply. Given that working temperature of filament is 2000°C and temp. co-efficient of resistance of filament at 15°C is 0.005 OC^{-1}. [6]

3. (*a*) Obtain the expression for composite capacitor having three dielectric materials. [6]

(*b*) Obtain the expression for r.m.s. value of current interms of its peak value. [6]

Or

4. (*a*) Draw the neat connection diagram and explain the procedure for finding voltage regulation and efficiency by direct loading method for transformer having ratings 1 KVA, 230/115 V, 1-ph, 50 H_2. Also write the proper ranges of meters. [6]

(*b*) A 50 H_2 alternating current having rms value 10A has instanteneous value of –7.07A at t = 0. Write down the equation for current and sketch the waveform stating all currents and phase angle. [6]

5. (*a*) What is series resonance ? Obtain the expression for resonant frequency. Also draw the phasor diagram. [6]

(*b*) Three identical impedances each of $6 + j8\ \Omega$ are connected in delta across 3-ph, 400 V, 50 Hz ac supply. Calculate

(*i*) Line current

(*ii*) Power factor

(*iii*) Active power

(*iv*) Reactive power. [7]

Or

6. (*a*) Define and explain following terms.

(*i*) Admittance

(*ii*) Phase sequence

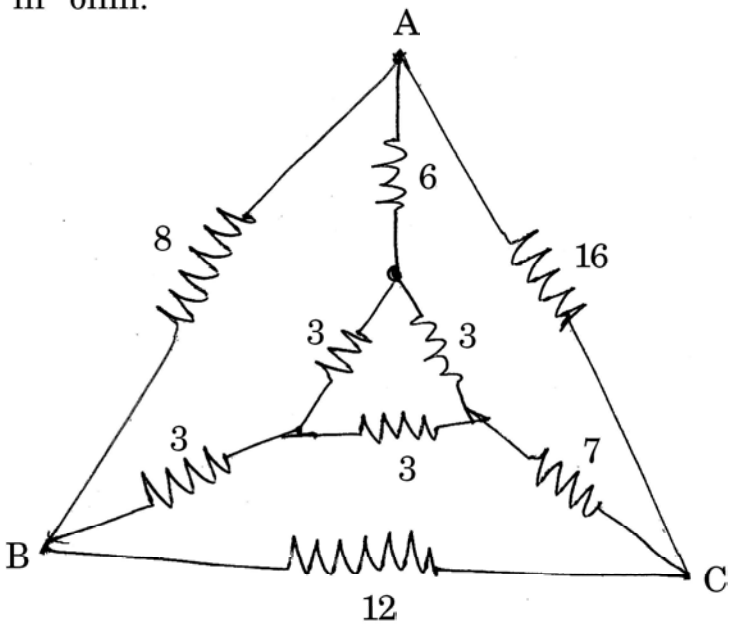
(*iii*) Balanced and unbalanced load. [6]

(*b*) Find the expression for current when $v = 282.84 \sin(314\ t)$ V is applied to coil having resistance 10 ohm and inductance 0.1 H. Also calculate the power consumed. [7]

SECTION II

7. (*a*) State and explain Kirchhoff's Laws. [6]

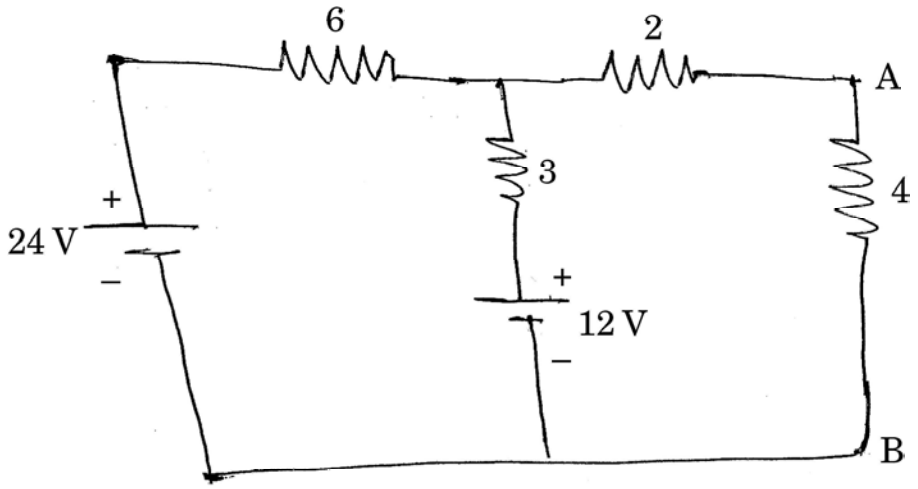
(*b*) Find the resistance between B and C. All the resistance values are in ohm. [7]



Or

8. (*a*) State and explain the Verins theorem. [6]

(*b*) Using Superposition Theorem, find current flowing through AB. All resistance values are in ohm. [7]



Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

Seat No.	

[4956]-105

F.E. (First Semester) EXAMINATION, 2016

BASIC ELECTRONICS ENGINEERING

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Figures to the right indicate full marks.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Use of electronic pocket calculator is allowed.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Draw and Explain full wave rectifier with capacitor filter. [6]

(*b*) Explain CE amplifier with the help of DC loadline. [6]

Or

2. (*a*) Explain with V-I characteristics the working of Zener diode as a voltage regulator. [6]

(*b*) Define α and β in case of transistor. Derive the relationship between them.

If $\alpha = 0.98$, Calculate value of β. [6]

3. (*a*) Draw a neat diagram of 3-input inverting summing amplifier and obtain expression for its o/p voltage. [6]

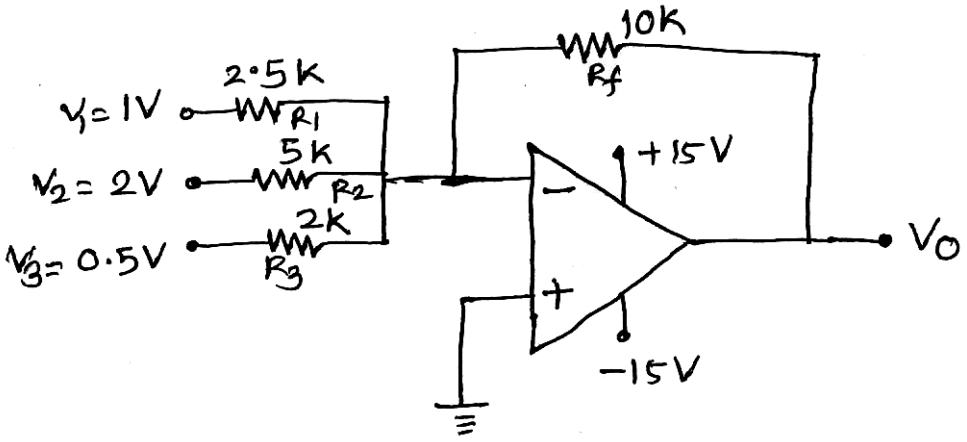
P.T.O.

(*b*) Compare synchronous and asynchronous counter. [4]

(*c*) State Demorgan's theorem. [2]

Or

4. (*a*) For the given circuit. Find V_o. [6]



(*b*) Compare microprocessar and microcontroller. [4]

(*c*) Explain how Ex-OR gate can be used as an inverter. [2]

5. (*a*) Draw a constructional diagram of SCR and Explain its working with the help of two transistor analogy. [6]

(*b*) With a neat diagram explain construction and working of LVDT. Give its advantages and applications. [7]

Or

6. (*a*) Compare : [6]

(*i*) SCR and TRIAC

(*ii*) DIAC and TRIAC.

(*b*) Draw and explain electronic weighting machine. [5]

(*c*) Define :

(*i*) Active Transducer

(*ii*) Passive Transducer. [2]

7. (*a*) Define AM. Derive expression for AM. Write expression for modulation index. Draw waveforms of AM. [7]

(*b*) Write short note on :

(*i*) Coaxial Cable

(*ii*) Fiber Optic Cable. [6]

8. (*a*) Draw and Explain block diagram of GSM system. [6]

(*b*) With respect to FM explain

(*i*) Frequency deviation

(*ii*) Modulation index

(*iii*) Deviation ratio

(*iv*) Frequency spectrum of FM. [7]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4956]-106

F.E. (Common) EXAMINATION, 2016
BASIC CIVIL AND ENVIRONMENTAL ENGINEERING
(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** and Q. No. **5** *or* Q. No. **6** Q. No. **7** *or* Q. No. **8**.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables, slide rule, Mollies charts, electronics pocket calculator and steam tables is allowed.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Assume suitable data, if necessary.

1. (*a*) Describe in brief the role of civil engineer in installations of heavy machines and equipments. [4]

(*b*) Define foundation. State its functions. [1+3]

(*c*) How you will correlate the importance of Environment Engineering and development activities ? Explain. [4]

Or

2. (*a*) Explain in brief the importance of Earthquake Engineering. What precautionary measures you will suggest in construction of any structure ? 2+2

P.T.O.

(*b*) What is combined footing ? Under what situations it is constructed. [1+3=4]

(*c*) Compare PCC and RCC by considering various points. [1+3]

3. (*a*) The following consecutive readings were taken with a dumpy level and 4 m leveling staff on a sloping ground. The readings are, 0.775, 1.045, 0.545, 1.845, 3.370, 0.935, 1.735, 3.215, 1.165, 2.990 and 3.985. The first readings was taken on permanent Bench mark of RL of 655.775 m. Calculate the reduced levels of staff stations by rise and fall method. Apply usual arithmetic check. [6]

(*b*) Explain the importance of natural resources in day to day life. [3]

(*c*) What do you mean by EIA. Why it is necessary ? [1+2]

Or

4. (*a*) How plan area of an irregular plot is measured ? Explain. [4]

(*b*) Compare the plan and map with respect to any four points. [1×4]

(*c*) Enlist various sources of electronic waste. How it affects our environment ? [1+3]

5. (*a*) "Privacy is the important principal of planning". Comment on the statement. [5]

(*b*) Describe different changes which are incorporated to make ordinary building to a Green building. [4]

(*c*) Explain the importance of circulation as a principle of planning. [4]

Or

6. (*a*) On a plot of 23 m × 20 m, a building of G + 1 is proposed with a built up area of 350 sq.m on ground and first floor. Wall area is 15% and permissible FSI is 0.8 All margins will be 1.5 m as per bye-laws. Find : [5]

(*i*) Plinth area of building

(*ii*) State with reason weather the plant will be sanctioned or not, based on allowable built up area as well as ground coverage.

(*b*) What is set back distance ? Why it is required ? Also state the prescribed values of setback distance for residential building. [4]

(*c*) Enlist important factors to be considered for selecting the site for residential building. [4]

7. (*a*) Highlight sources of increase in noise level and preventive measures to reduce its effects. [4]

(*b*) State various non conventional sources of energy. Why these sources cannot be an alternative to conventional sources of energy ? [1+4]

(*c*) State various greenhouse gases. What are the ill effects of these gases on environment ? [1+3]

Or

8. (*a*) Describe various remedial measures to abate land pollution. [4]

(*b*) Explain in brief the mechanism of production of Bio-gas energy. [5]

(*c*) How energy from ocean is extracted ? Explain. [4]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4956]-107

F.E. (Common) EXAMINATION, 2016

ENGINERING GRAPHICS-I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Figures to the right side indicate full marks.

(*iii*) Assume suitable data if necessary.

(*iv*) Retain construction lines.

(*v*) Marks are reserved for dimensioning and good presentation.

1. The end A of line AB is 20 mm above HP while its end B is 10 mm infront of VP. Its plan and elevation makes an angle of 40° and 45° with XY respectively. Draw the projection of line, if the distance between end projectors of line is 60 mm. Find its true length, inclination with HP and VP. Also, locate its traces. [12]

Or

2. A pentagonal plate of 40 mm side is resting on VP on one of its sides such that the corner opposite to it is 25 mm infront of VP. The side in VP makes an angle of 20° with HP. Draw its projections and find its inclination with HP & VP. [12]

P.T.O.

3. A regular hexagonal pyramid, side of base 25 mm and height 60 mm is resting on one of its corner on HP such that slant edge passing through the resting corner is perpendicular to HP and plan of axis is inclined at 45° to VP. Draw its projections when apex is towards the observer. [13]

Or

4. (*a*) The major and minor diameter of an ellipse is 110 and 90 mm respectively. Draw an ellipse rectangle method. [7]

(*b*) Draw the development of lateral surface of hexagonal prism having side of base 35 mm and height 70 mm. [6]

5. The following Fig No. 1 shows a cast iron bracket. By using first angle projection method draw : [13]

(1) Front view along arrow X

(2) Top view

(3) Sectional LHSV along plane A-A

Give all the dimensions :

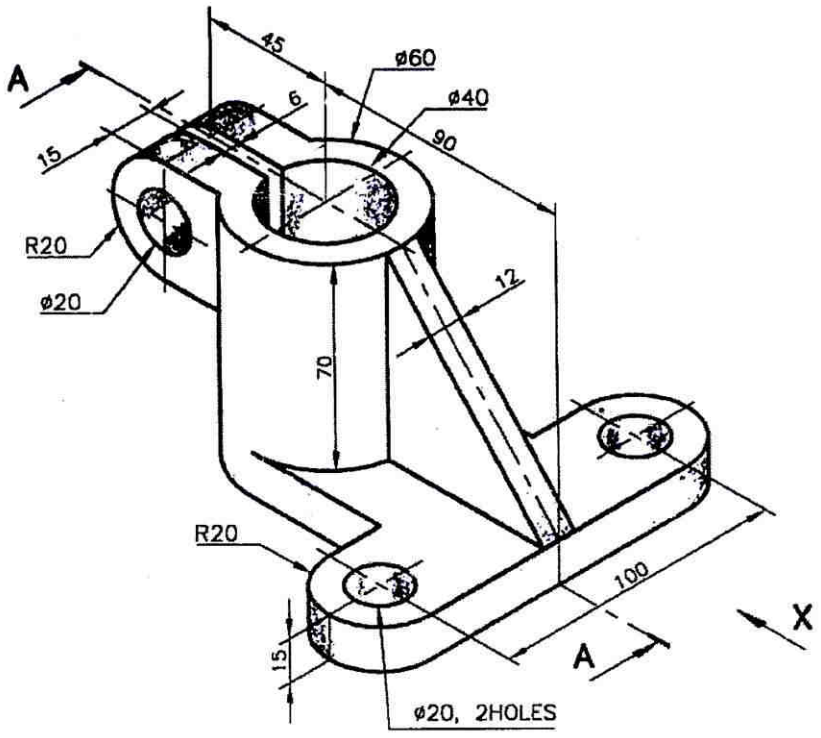


Fig No. 1 C.I. Bracket

Or

6. The following Fig. No. 2 shows a cast iron bracket. By using first angle projection method draw : [13]

(1) Sectional front view along plane A-A

(2) Top view

(3) LSHV

Give all the dimensions.

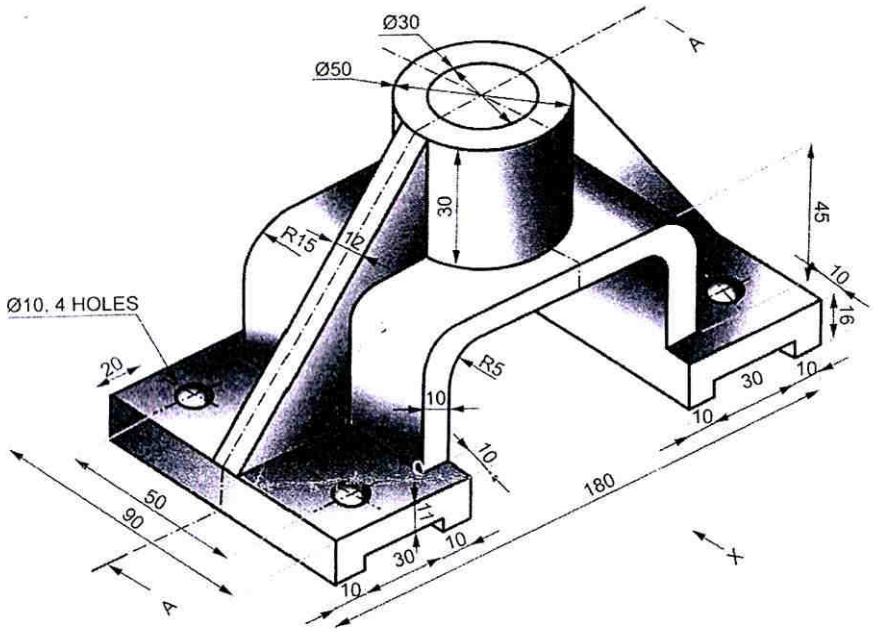


Fig No. 2 C.I. Bracket

7. Fig. No. 3 shows the FV and LHSV of an object. Draw the isometric view using natural scale. [12]

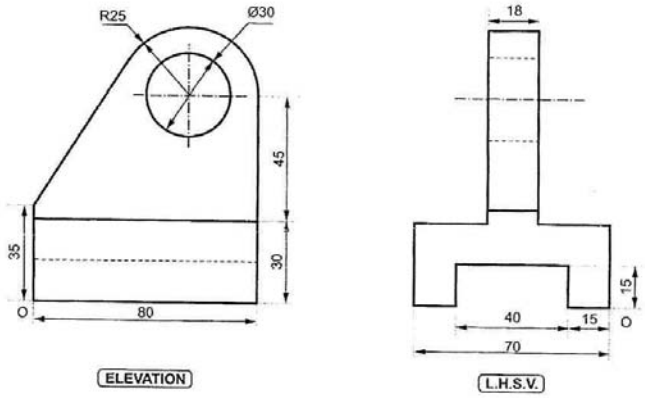


Fig. No. 3

Or

8. Fig. No. 4 shows the FV and Top view of an object. Draw the isometric view using natural scale. [12]

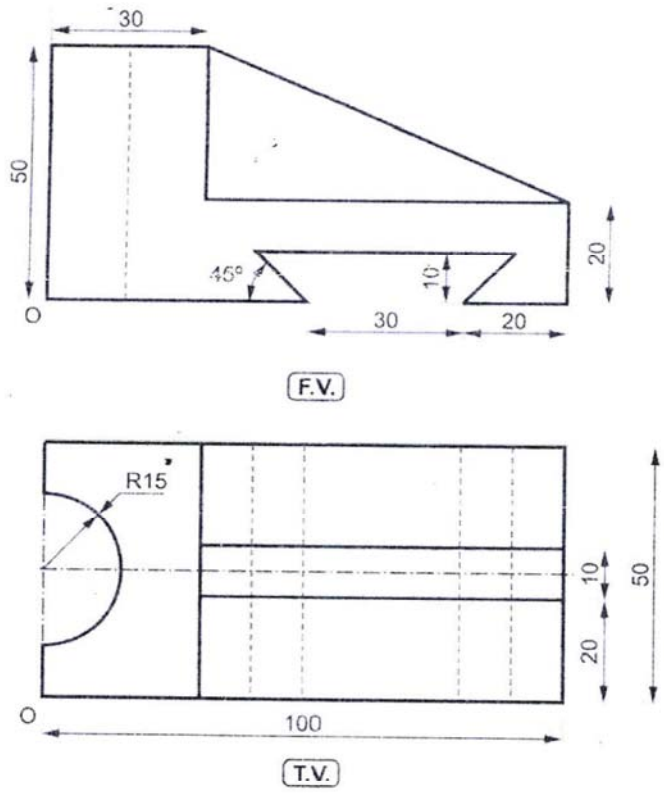


Fig. No. 4

Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4956]-108

F.E. EXAMINATION, 2016

ENGINEERING MATHEMATICS—II

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Attempt *four* questions : Q. No. **1** *or* Q. No. **2,** Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6,** Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of electronic non-programable calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Solve the following differential equations : [8]

(*i*) $\frac{dy}{dx} = \frac{2x - 3y + 1}{3x + 4y - 5}$

(*ii*) $x \cos x\frac{dy}{dx} + (\cos x - x \sin x)\, y = 1.$

(*b*) Assuming that the resistance to movement of a ship through water in the form of $(a^2 + b^2 v^2)$, where v is the velocity, a and b are constants, write down the differential equation

P.T.O.

for retardation of ship moving with engine stopped. Prove that the time in which the speed falls to one half its original value u is given by :

$$\frac{w}{abg} \tan^{-1}\left(\frac{abu}{2a^2 + b^2 u^2}\right)$$

where w is the weigth of the ship. [4]

Or

2. (*a*) Solve : [4]

$$y \log y \, dx + (x - \log y) \, dy = 0$$

(*b*) Solve the following : [8]

(*i*) A body of temperature 80°F is placed in a room of constant temperature 50°F at time $t = 0$. At the end of 5 minutes the body was cooled to a temperature of 70°F. Find the time at which temperature of the body will be 60°F.

(*ii*) A capacitor C = 0.01 F in series with a resistor R = 20 Ω is charged from a battery 10 Volts. Assuming that initially the capacitor is completely uncharged, determine the charge Q(t) and current I(t) in the circuit.

3. (*a*) Find the Fourier series of : [5]

$$f(x) = x^3, \; -\pi < x < \pi.$$

(*b*) Evaluate : [3]

$$\int_0^{\infty} \frac{x^9\left(1 - x^5\right)}{\left(1 + x\right)^{25}} dx .$$

(*c*) Trace the following curve (any *one*) : [4]

(*i*) $x = a(t + \sin t),\ y = a(1 + \cos t)$

(*ii*) $r = a \cos 3\theta.$

Or

4. (*a*) If [4]

$$I_n = \int_0^{\pi/4} \sec^n \theta \, d\theta ,$$

prove that :

$$I_n = \frac{\left(\sqrt{2}\right)^{n-2}}{n - 1} + \frac{n + 2}{n - 1} I_{n-2}.$$

(*b*) If [4]

$$f(x) = \int_2^x \left(x - t\right) G\left(t\right) dt$$

then show that :

$$\frac{d^2 f}{dx^2} - G(x) = 0.$$

(*c*) Find the length of arc of an Astroid : [4]

$$x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}.$$

5. (*a*) Show that the plane

$$2x - 2y + z + 12 = 0$$

touches the sphere

$$x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0.$$

Also find the point of contact. [5]

(*b*) Find the equation of right circular cone passing through (2, –2, 1) with vertex at origin and axis parallel to the line : [4]

$$\frac{x-2}{5} = \frac{y-1}{1} = \frac{z+2}{1}.$$

(*c*) Find the equation of right circular cylinder whose axis is :

$$x = 2y = -z$$

and radius is 4. [4]

Or

6. (*a*) Find the equation of the sphere which has its centre at (2, 3, –1) and touches the line : [5]

$$\frac{x+1}{-5} = \frac{y-8}{3} = \frac{z-4}{4}.$$

(*b*) Find the equation of the cone with vertex at (1, 2, –3), semi-vertical angle $\cos^{-1}\frac{1}{\sqrt{3}}$ and the line :

$$\frac{x-1}{1} = \frac{y-2}{2} = \frac{z+1}{-1}$$

as the axis of the cone. [4]

(*c*) Find the equation of right circular cylcinder of raidus 2 with the axis : [4]

$$\frac{x-1}{2} = \frac{y}{3} = \frac{z-3}{1}.$$

7. Attempt any *two* of the following :

(*a*) Evaluate : [6]

$$\iint \frac{1}{x^4 + y^2} dxdy$$

over the region

$$y \geq x^2, \; x \geq 1.$$

(*b*) Evaluate : [7]

$$\iiint \frac{dxdydz}{\sqrt{1 - x^2 - y^2 - z^2}}$$

taken throughout the volume of the sphere :

$$x^2 + y^2 + z^2 = 1$$

in the positive octant.

(*c*) Find the area bounded by the parabola

$$y^2 = 4x$$

and the straight line : [6]

$$2x - 3y + 4 = 0.$$

Or

8. Attempt any *two* of the following :

(*a*) Evaluate : [6]

$$\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2-y^2}} \log_e\left(x^2 + y^2\right) dx dy .$$

(*b*) A rod of length l is divided into two parts at random. Find average of sum of squares of these parts. Also find mean value of rectangle contained by these two segments. [7]

(*c*) Find the volume common to the cylinders : [6]

$$x^2 + y^2 = a^2 \text{ and}$$

$$x^2 + z^2 = a^2.$$

Total No. of Questions—**6**] [Total No. of Printed Pages—**8+3**

Seat No.	

[4956]-111

F.E. (Common) EXAMINATION, 2016
ENGINEERING MECHANICS
(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** and Q. No. **5** *or* Q. No. **6**.
(*ii*) Neat diagram must be drawn wherever necessary.
(*iii*) Figures to the right indicate full marks.
(*iv*) Assume suitable data, if necessary and clearly state.
(*v*) Use of cell phone is prohibited in the examination hall.
(*vi*) Use of electronic pocket calculator is allowed.

1. (*a*) The post is to be pulled out of the ground using two ropes A and B as shown in Fig. 1 (*a*). Rope A is subjected to a force of 600 N and is directed at 60° from the horizontal. If the resultant force acting on the post is be 1200 N vertically upward, determine the force T in rope B and the corresponding angle θ. [4]

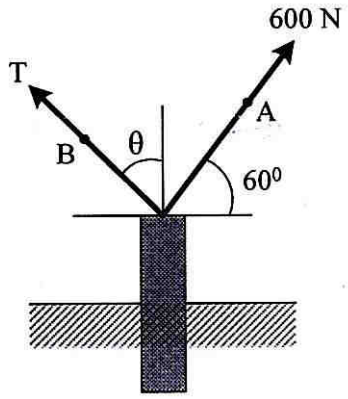


Fig. 1 (*a*)

P.T.O.

(*b*) If a block A of the pulley system is moving downward at 2 m/s while block C is moving down at 6 m/s, determine the relative velocity of block B with respect to C. Refer Fig. 1 (*b*). [4]

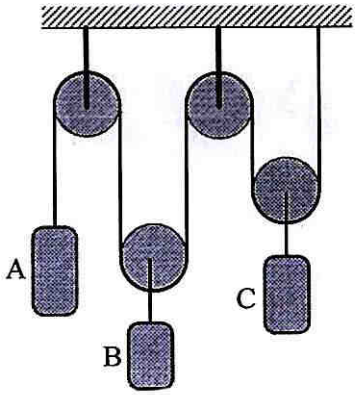


Fig. 1 (*b*)

(*c*) Water flows from a drain spout with an initial velocity of 0.75 m/s at an angle of 75° with the vertical as shown in Fig. 1(*c*). Determine the range of values of the distance d for which the water will enter the trough BC. [4]

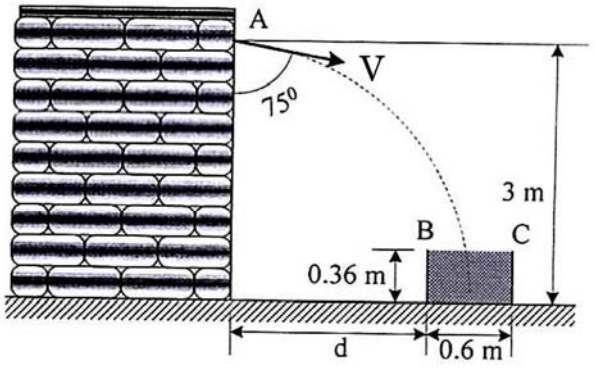


Fig. 1 (*c*)

(*d*) Block A has a weight of 300 N and block B has a weight of 50 N. Determine the speed of block A after it moves 1.5 m above the plane, starting from rest by work energy principle. Neglect the friction and mass of the pulleys. Refer Fig. 1 (*d*). [4]

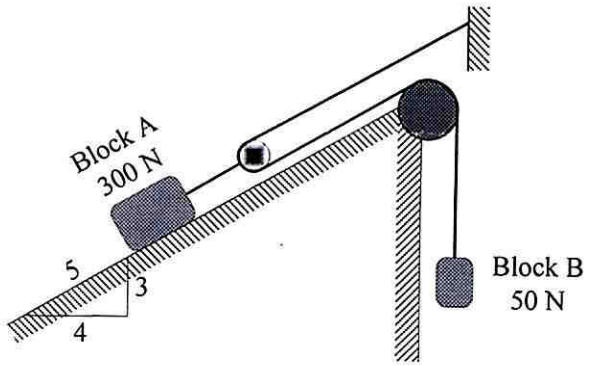


Fig. 1 (*d*)

Or

2. (*a*) A slender rod is welded into the shape as shown in Fig. 2(*a*) Locate the position of centroid of the rod with respect to origin O if AO = BO = CO = 50 mm : [4]

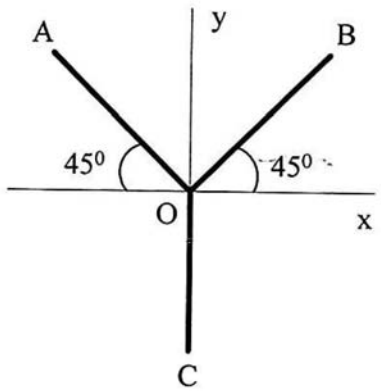


Fig. 2(*a*)

(*b*) Block B rest on smooth surface. If the coefficient of static and kinetic friction between A and B are μ_s = 0.4 and μ_k = 0.3 respectively, determine the acceleration of each block if a block A is push with a force F :

(*a*) 30 N

(*b*) 250 N. Refer Fig. 2 (*b*) [4]

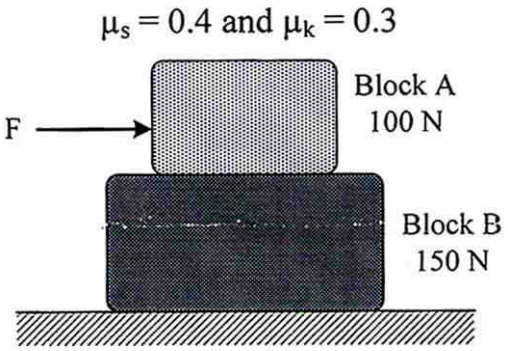


Fig. 2 (*b*)

(*c*) The man has a mass of 80 kg and sits 3 m from the center of the rotating platform. Due to the rotation his speed is increased from rest by 0.4 m/s^2. If the coefficient of static friction between his clothes and the platform is, μ_s = 0.3, determine the time required to cause him to slip. Refer Fig. 2 (*c*). [4]

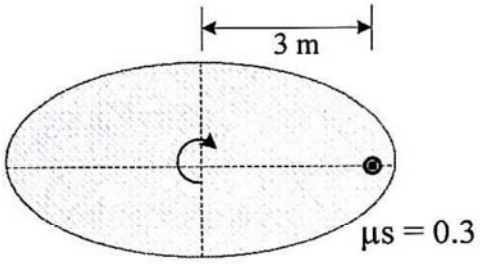


Fig. 2 (*c*)

(*d*) Each of the cable can sustain a maximum tension of 25 kN. If the uniform beam has a weight of 25 kN, determine the shortest time possible to lift the beam with a speed of 3 m/s starting from rest by impulse momentum principle. Refer Fig. 2 (*d*). [4]

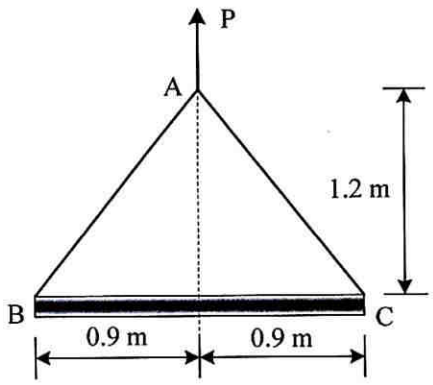


Fig. 2 (*d*)

3. (*a*) The boom is intended to support two vertical loads, F_1 and F_2 as shown in Fig. 3 (*a*). If the cable CB can sustain a maximum load of 1500 N before it fails, determine the critical loads F_1 and F_2 if $F_1 = 2F_2$. Also determine the reaction at A : [6]

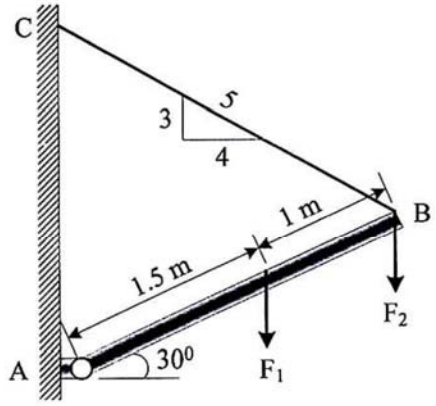


Fig. 3 (*a*)

(*b*) Three parallel bolting forces act on the rim of the circular cover plate as shown in Fig. 3 (*b*). Determine the magnitude, nature and point of application of the resultant force with respect to origin O. [6]

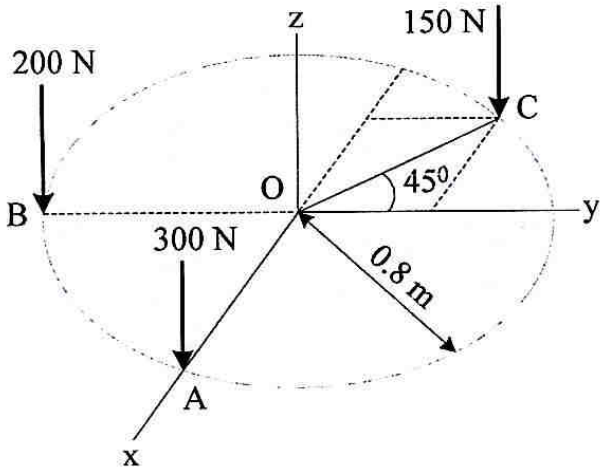


Fig. 3 (*b*)

(*c*) Determine reaction at A and B for the beam loaded and supported as shown in Fig. 3 (*c*). [5]

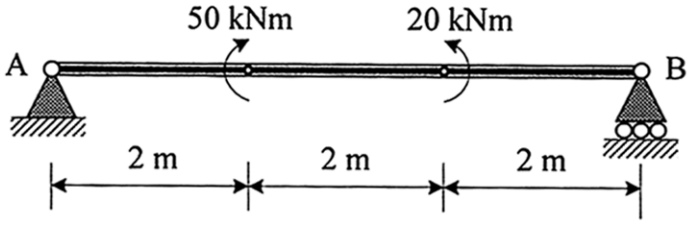


Fig. 3 (*c*)

Or

4. (*a*) The 30 kg pipe is supported at A by a system of five cords as shown in Fig. 4 (*a*). Determine the force in each cord for equilibrium. [6]

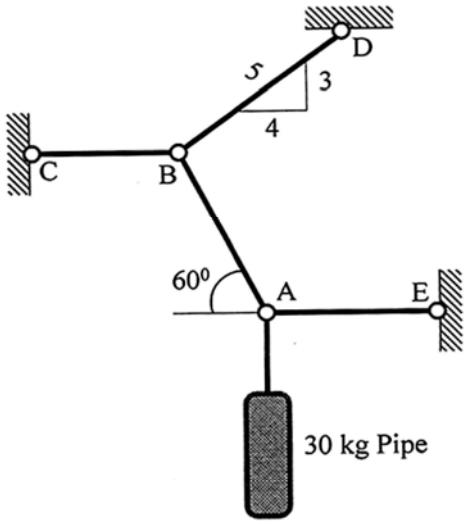


Fig. (*a*)

(*b*) A 90 N load is suspended from the hook shown in Fig. 4 (*b*). The load is supported by two cables and a spring having stiffness k = 500 N/m. Determine the force in the cables and the stretch of the spring for equilibrium. Cable AD lies in the x-y plane and cable AC lies in the x-z plane :

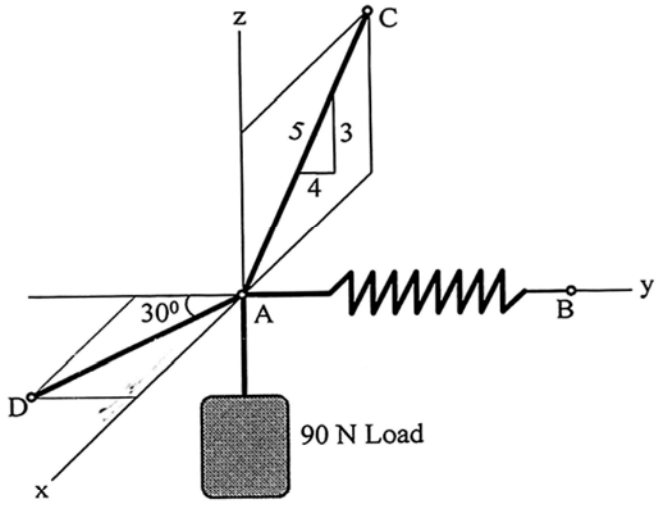


Fig. (*b*)

(*c*) A simply supported beam loaded and supported is as shown in Fig. 4 (*c*). If the reactions at supports are equal in magnitude, determine the overhang **a**. [5]

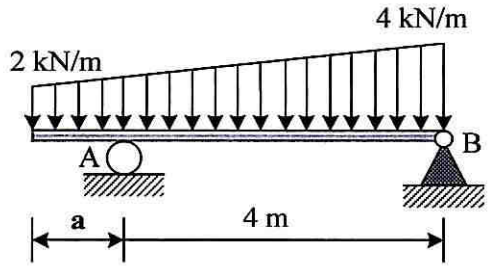


Fig. 4 (*c*)

5. (*a*) A uniform hoop of weight W is suspended from the peg at A and a horizontal force P is slowly applied at B as shown in Fig. 5 (*a*). If the hoop begins to slip at A when $\theta = 30°$, determine the coefficient of static friction between the hoop and the peg. [6]

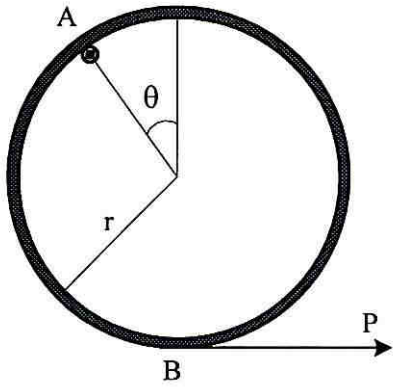


Fig. 5 (*a*)

(*b*) Determine the force in each member of the truss as shown in Fig. 5 (*b*) and tabulate the result with magnitude and nature of force in the members. [6]

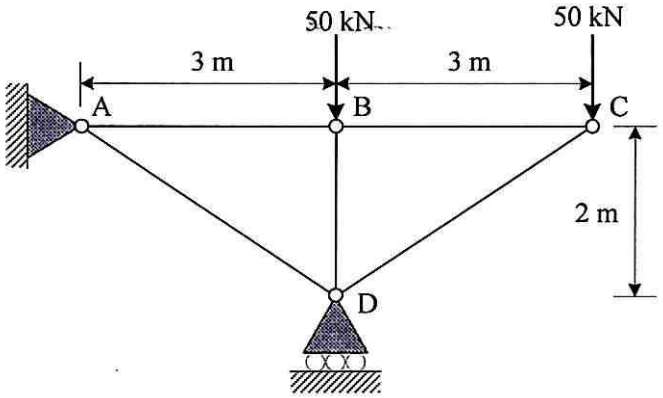


Fig. 5 (*b*)

(*c*) Determine the horizontal and vertical component of reactions at A and B for the frame loaded and supported as shown in Fig. 5 (*c*). [5]

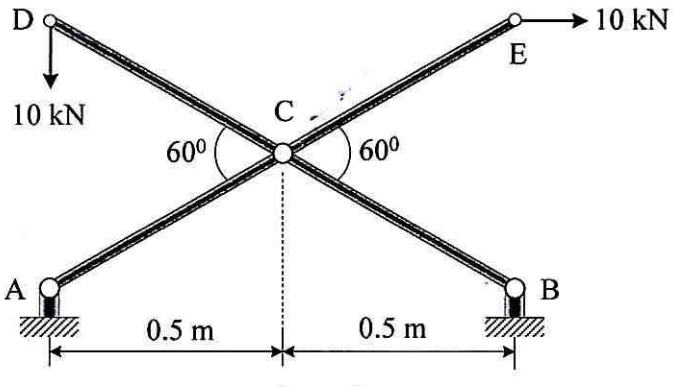


Fig. 5 (*c*)

Or

6. (*a*) The uniform pole of length l and mass m is leaned against the vertical wall as shown in Fig. 6 (*a*). If the coefficient of static friction between supporting surfaces and the ends of the pole is 0.25, calculate the maximum angle θ at which the pole may place before it starts to slip. [6]

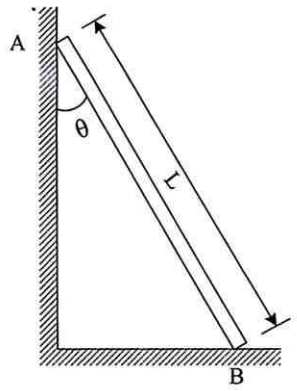


Fig. 6 (*a*)

(*b*) Cable ABCD supports the 4 kg block E and 6 kg block F as shown in Fig. 6(*b*). Determine the maximum tension in the cable and the sag of point B. [6]

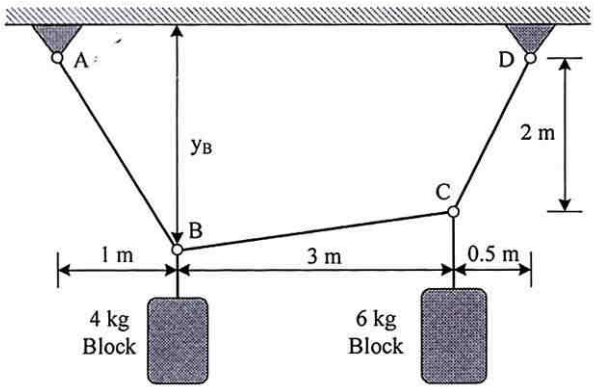


Fig. 6 (*b*)

(*c*) The homogeneous semi-cylinder has a mass m and mass center at G as shown in Fig. 6 (*c*). Determine the largest angle θ of the inclined plane upon which it rest so that it does not slip down the plane. The coefficient of static friction between the plane and the cylinder is 0.3. [5]

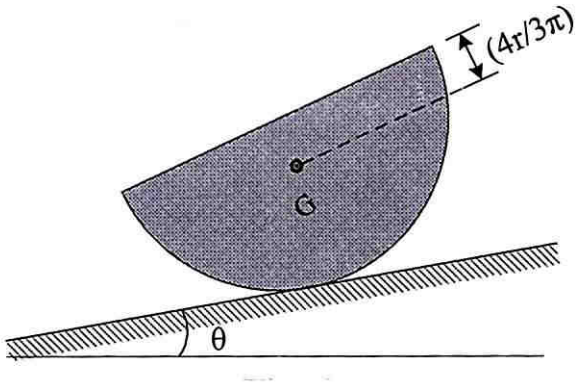


Fig. 6 (*c*)

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

Seat No.	

[4956]-114

F.E. (II Semester) Examination, 2016
BASIC MECHANICAL ENGINEERING
(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Assume suitable data, if necessary.
(*ii*) Figures to the right indicate full marks.
(*iii*) Neat diagrams must be drawn wherever necessary.
(*iv*) Use of non-programmable electronic Calculator is permitted.
(*v*) Attempt *four* questions out of eight : Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

1. (*a*) What is machine ? How are machine elements classified ? [4]
(*b*) Explain working of disc brake with schematic (simple) sketch. [4]
(*c*) How are engineering materials classified ? Write a short note on plain carbon steel. [4]

Or

2. (*a*) Explain the following machine elements : [6]
(*i*) Clutch and Coupling
(*ii*) Open belt drive and Cross belt drive
(*iii*) Spur gear drive
(*b*) Define machanism, machine and state their examples. Explain the mechanism used in four stroke, spark ignition engine with neat sketch. [6]

3. (*a*) Draw neat sketch of sand casting process setup. State applications of the process. [4]

P.T.O.

(*b*) Identify and explain suitable manufacturing process to join two copper tubes. [4]

(*c*) Explain drilling operation performed on lathe machine and radial drilling machine. [4]

Or

4. (*a*) Explain hot forging process with neat sketch. [4]

(*b*) Draw self-explanatory sketches of various sheet metal cutting process. [4]

(*c*) Identify and explain suitable manufacturing process to impart smooth surface finish and dimensional accuracy to piston pins, balls and rollers of rolling contact bearing etc. [4]

5. (*a*) Explain the following terms : [4]

(*i*) Zeroth law of thermodynamics

(*ii*) Extensive properties

(*iii*) Open system

(*iv*) Heat engine

(*b*) Explain measurement of pressure using simple U-tube manometer. [4]

(*c*) A heat pump is used to maintain the house at 24 degree C. The house is losing the heat at the rate of 1800 kJ/min to the surrounding. The heat pump is driven by an electric motor of power rating 12 kW. Find : [5]

(*i*) The amount of heat absorbed from surrounding.

(*ii*) COP of the heat pump.

Draw the sketch of the system.

Or

6. (*a*) The pressure of gas flowing through a pipe is to be measured with simple U-tube mercury manometer. Left arm of the U-tube is connected to gas pipe while right arm is open to atmosphere. Calculate the absolute pressure of the gas when the level of mercury, in the arm open to atmosphere is : Case (A) 300 mm higher than the level of mercury in left arm and Case (B) 200 mm lower than the level of mercury in left arm.

Draw sketch of the system for case (A) and case (B).

Given : Atmospheric pressure = 10 m of water column

Acceleration due to gravity = 9.81 m/sec^2

Density of mercury = 13600 kg/m^3 [6]

(*b*) Explain "Kelvin-Plack and Clausius" statement of second law of thermodynamics. [4]

(*c*) Draw a sketch of Heat Pump and Refrigerator using Heat Source & Sink concept. [3]

Prove that : $(COP)_{\text{Heat Pump}} = 1 + (COP)_{\text{Refrigerator}}$

7. (*a*) Draw a layout of solar power plant. What are the limitations of the plant ? [4]

(*b*) Differentiate between Impulse and Reaction turbine (4 points). [4]

(*c*) Explain working of reciprocating pump with neat diagram and state its application. [5]

Or

8. (*a*) Draw a layout of hydro-electric power plant and explain the energy extraction (energy conversion) process. [4]

(*b*) Explain classification of boilers in brief. [4]

(*c*) What do you mean by air-conditioning ? Draw a neat sketch of window air-conditioning system. Show the direction of hot and cool air-flow. [5]

Total No. of Questions—**12**] [Total No. of Printed Pages—**6**

Seat No.	

[4957]-122

S.E. (MECHANICAL S/W) (Semester–II) EXAMINATION, 2016

THEORY OF MACHINE AND MACHINE DESIGN–I

(2008 PATTERN)

Time : Four Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section-I

(*ii*) Answer Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.

(*iii*) Answers to the two Sections should be written in separate answer-books.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Use of electronic pocket calculator is allowed.

SECTION-I

UNIT-I

1. (*a*) Explain the following terms with suitable examples : [6]

(*i*) Completely constrained motion

(*ii*) Incompletely constrained motion

(*iii*) Successfully constrained motion.

(*b*) Define kinematic pair and discuss various types of kinematic pairs with examples. [10]

P.T.O.

Or

2. (*a*) Explain with neat sketches "Swinging and Rocking Mechanisms. [4]

(*b*) Explain the following mechanisms with neat sketch : [12]

(*i*) Pendulum pump

(*ii*) Crank and slotted lever quick return mechanism.

(*iii*) Whithworth quick return mechanism.

(*iv*) Elliptical trammel.

UNIT-II

3. (*a*) State and explain Kennedy's theorem. [4]

(*b*) The mechanism shown in Fig. 1, in which the crank OA rotates at 120 rpm in clockwise direction. Determine by using relative velocity and relative acceleration method : [12]

(*i*) Velocity and acceleration of piston D.

(*ii*) Angular velocity and angular acceleration of link AB.

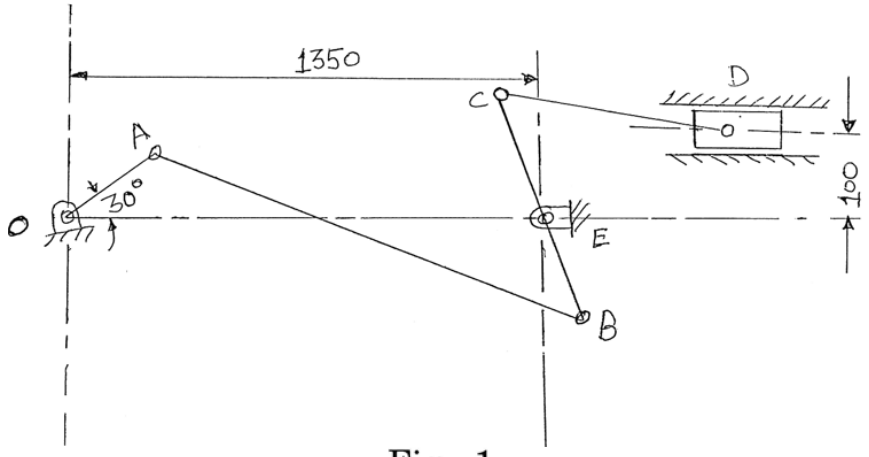


Fig. 1

OA = 200, AB = 1500

BC = 600, CD = 500

BE = 400 All dimensions are in mm

Fig. not to scale

Or

4. (*a*) Derive loop closure equation for four bar mechanism. [4]

(*b*) The mechanism shown in Fig. 1, in which the crank OA rotates at 120 rpm in clockwise direction. Determine by using instantaneous centre method : [12]

(*i*) Velocity of pin B and piston D

(*ii*) Angular velocities of link AB and CD.

UNIT-III

5. (*a*) Write short notes on : [8]

(*i*) Correction couple

(*ii*) D'Alembert's principle.

(*b*) Derive formula for velocity of slider analytically for single slider crank mechanism. [10]

Or

6. (*a*) In slider crank mechanism, the crank is 200 mm long and connecting rod 800 mm long. The piston is of 80 mm in diameter and gas pressure acting on the piston is 6 MPa. When the crank has moved through 45º from IDC. Find : [10]

(*i*) Thrust in connecting rod

(*ii*) Piston side thrust

(*iii*) Torque acting on crankshaft and

(*iv*) Radial load.

(*b*) Explain the method of bifilar suspension to find out radius of gyration and mass moment of inertia of rigid body ?[8]

SECTION-II

UNIT-IV

7. (*a*) Compare the weight, strength and stiffiness of a hollow shaft of the same external diameter as that of sloid shaft. The inside diameter of the hollow shaft being half the external diameter. Both the shafts have same material and length. [10]

(*b*) Give the classification of keys and explain the procedure of designing key. [6]

Or

8. (*a*) Explain protected type and unprotected type flange coupling. [6]

(*b*) A protected type flange coupling is used to transmit 25 kW power at 500 rpm from an engine to a machine. Design the coupling for an overload capacity of 25%. Assume the following permissible stresses : [10]

	Cl Flanges	**Shaft & Key**	**Bolts**
Permissible tensile stress, MPa	20	60	60
Permissible shear stress, MPa	12	35	28
Permissible compressive stress, MPa	60	60	60

UNIT-V

9. (*a*) Write notes on : [6]

(*i*) Differential and Compound screws

(*ii*) Nipping of leaf spring.

(*b*) A valve spring of an IC engine is to be designed for the following details :

Spring load = 80 N when valve is closed, spring load = 100 N When valve is open space constraints for the fitment of the spring are : Inside guide bush diameter = 24 mm, Outside recess diameter = 36 mm, Valve lift = 5 mm.

Spring steel has the following properties :

Permissible shear stress = 355 MPa, Modulus of rigidity = 8×10^4 N/mm^2

Spring ends = squared and ground

Design :

(*i*) Wire diameter,

(*ii*) Spring index,

(*iii*) Total number of coils,

(*iv*) Solid length of the spring,

(*v*) Free length of the spring

When additional 15% of working deflection is used to avoid complete closing of coils. [10]

Or

10. (*a*) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity G = 84 kN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensaioned sketch of the spring, showing details of the finish of end coils. [10]

(*b*) Explain the following terms of the spring : [6]

(*i*) Free length

(*ii*) Solid length

(*iii*) Spring rate

(*iv*) Active and inactive coils

(*v*) Spring index

(*vi*) Stress factor.

UNIT-VI

11. (*a*) Derive condition to transmit maximum power in term of maximum allowable tension centrifugal tension in the belt at that speed. [4]

(*b*) A 5 kW induction motor running at 960 rpm operates a riveting machine. The flywheel to it is of mass 120 kg with radius of gyration equal to 0.35 m. Each riveting takes 1 second and required 9 kW, determine :

(*i*) The no. of rivets form per hour

(*ii*) The reduction in speed of flywheel after riveting operation. [8]

(*c*) Discuss in detail stresses in flywheel rim. [6]

Or

12. Write short notes on the following : [18]

(*a*) Turning moment diagram for 4S internal combustion engine.

(*b*) Construction of flywheel

(*c*) Design considerations in flat and V pulley drives

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4957]-123

S.E. (Mechanical Sandwich) (Second Semester) EXAMINATION, 2016

THERMAL ENGINEERING II

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer to the two Sections should be writen in separate-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right side indicate full marks.

(*iv*) Use of steam table, calcultor is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain with neat sketch simple vapour absorption cycle. [8]

(*b*) The temperature limits of an ammonia refrigerating system are 25°C and –10°C. If the gas is dry at the end of compression, calculate the coefficient of performance of the cycle assuming no undercooling of the liquid ammonia. Use of the following table for properties of ammonia :

Temperature (°C)	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Liquid entropy (kJ/kgk)
25	298.9	1166.94	1.1242
–10	135.37	1297.68	0.5443

P.T.O.

Or

2. (*a*) Write a short note on Alternative refrigerants'. [8]

(*b*) A bell-Coleman refrigerator operates between pressure limits of 1 bar and 8 bar. Air is drawn from the cold chamber at 9°C, compressed and then it is cooled t0 29°C before entering the expansion cylinder. Expansion and compression follows the law $Pv^{1.35}$ = constant.

Calculate the theoretical C.O.P. of the system.

For air take γ = 1.4, C*p* = 1.003 kJ/kg K. [8]

3. (*a*) Explain comfort and industrial air conditioning. [4+4]

(*b*) Define the following terms : [8]

(*i*) Dry bulb temperature

(*ii*) Dew point temperature

(*iii*) Relative humidity

(*iv*) Specific humidity.

Or

4. (*a*) Explain the factors that determine human comfort. What is effective temperature ? [4+4]

(*b*) Describe briefly any *two* of the following process : [8]

(*i*) Sensible heating

(*ii*) Cooling and dehumidification

(*iii*) Heating and humidification.

5. (*a*) Write a short note on the types of refrigeration compressors. [8]

(*b*) Explain any one method of air conditioning duct design. [6]

(*c*) List precautions to be taken for trouble free operation of Domestic refrigerator. [4]

Or

6. (*a*) Derive an expression for the equivalent diameter of a circular duct corresponding to a rectangular duct of side 'a' and 'b' for the same pressure loss per unit length when : [8]

(*i*) The quantity of air passing through both the ducts is same.

(*ii*) The velocity of air flowing through both ducts is same.

(*b*) Explain working of capillary tube and list its advantages and disadvantages. [6]

(*c*) Which materials are used for making ducts in the air conditioning systems ? [4]

SECTION II

7. (*a*) Discuss various methods of cooling internal combustion engine giving merits and demerits of each. [8]

(*b*) Explain :

(*i*) quality governing and

(*ii*) quantity governing of IC engine.

Or

8. (*a*) Explain battery ignition system with a neat sketch. [8]

(*b*) What are the various methods for measuring friction power ? Describe any one method of measurement of friction power. [8]

9. (*a*) Explain teh stages of combustion in SI engines with neat sketch. [8]

(*b*) What are the basic requirements of good CI engine combustion chamber ? [8]

Or

10. (*a*) Explain the detonation in SI engine and factors affecting detonation. [4+4]

(*b*) Explain the terms : [2×4]

(*i*) Pre-ignition

(*ii*) Auto-ignition

(*iii*) Ignition lag

(*iv*) Octane number

11. (*a*) Discuss in detail Exhaust Emission from S.I. and C.I engines and their harmful effects. [10]

(*b*) Explain any *two* methods of turbocharging with neat sketch. [8]

Or

12. (*a*) Explain Exhaust Gas Recirculation (EGR) system. [10]

(*b*) What do you mean by supercharging ? Explain the advantages and limitation of supercharging. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4957]-124

S.E. (Mech. S/W) (Second Semester) EXAMINATION, 2016

MANUFACTURING ENGINEERING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the *two* Section should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables in allowed.

(*vi*) Assume suitable data, if necessary.

Section I

1. (*a*) Explain various types of patterns with neat sketch. List out materials used for pattern. [6]

(*b*) Describe the properties of sand used for moulding. [4]

(*c*) Describe the following processes with neat sketch :

(*i*) Wire drawing

(*ii*) Shot peening. [8]

P.T.O.

Or

2. (*a*) What are various casting defects ? How can these defects be minimised ? [6]

(*b*) What is extrusion ? How does direct extrusion differ from indirect extrusion ? Discuss their relative merits and demerits. [8]

(*c*) Describe with neat sketch process of Roll Forging. [4]

3. (*a*) Explain principle of resistance welding. What are the types and applications. Explain :

(*i*) Seam welding

(*ii*) Projection welding. [8]

(*b*) Describe various tnypes of adhesives and explain the reasons for replacing other joining processes by adhesive bonding with suiable example/application. [8]

Or

4. (*a*) Describe with the help of suitable working setup, the principle and operation of SMAW. Explain process of shielding used in SMAW. [8]

(*b*) Write a short note on :

(*i*) Flames used for gas welding process

(*ii*) Comparison between welding, soldering, brazing. [8]

5. (*a*) List different accessories used on lathe and state purpose of each with neat sketch. [8]

(*b*) Sketch and explain the following :

(*i*) Reaming

(*ii*) Tapping

(*iii*) Countersinking

(*iv*) Spot facing. [8]

Or

6. (*a*) Explain with neat sketch the following milling operations : [9]

(*i*) Plain milling

(*ii*) Form milling

(*iii*) Straddle milling.

(*b*) Explain the principle of boring machine. Give classification of boring machines. Explain vertical boring machine with neat sketch. [7]

Section II

7. (*i*) What are the types of tool failures ? Explain flank wear and crater wear. [4]

(*ii*) Explain working principle of generating the gears with neat figure of gear hobbing. [4]

(*iii*) How does thread milling differ from thread cutting ? [4]

(*iv*) The following data relate to an orthogonal cutting process : Chip length obtained = 96 mm Uncut chip length = 240 mm Rake angle used = 20° Depth of cut = 0.6 mm Horizontal and vertical components of cutting force = 2400 N and 240 N respectively. Determine :

(*a*) Chip thickness (tc)

(*b*) Shear plane angle (φ)

(*c*) Friction angle (β)

(*d*) Resultant cutting force (R). [6]

Or

8. (*i*) Prove the relation between chip thickness, rake angle and shear angle. [4]

(*ii*) What are various gear finishing methods ? [4]

(*iii*) What are the types of broaching machine ? Explain any *two*. [4]

(*iv*) Cylindrical bars of 100 mm diameter and 576 mm length are turned in a single pass operation. The spindle speed used is 144 r.p.m. and tool feed is 0.2 mm/rev. Taylor's tool life relationship is : $VT^{0.75} = 75$

Calculate :

(*a*) Time for turning one piece

(*b*) Tool life. [6]

9. (*i*) How do you classify CNC machines ? Compare open loop and closed loop control system in CNC with figures. [5]

(*ii*) Explain with neat sketch, working principles and process parameters and application of Electro-Discharge machining. [5]

(*iii*) Write short notes on (any *two*) :

(*a*) Automatic tool changer

(*b*) Ultrasonic machining process

(*c*) Plasma arc machining process. [6]

Or

10. (*i*) What is NC system ? Explain its elements and types of NC control systems. [5]

(*ii*) Explain with neat sketch, working principles and process parameters and application of Abrasive jet machining. [5]

(*iii*) Write short notes on (any *two*) :

(*a*) Automatic pallet changer

(*b*) DNC

(*c*) Laser beam machining. [6]

11. (*i*) State different types of dies used in press working operations. Explain any one die. [4]

(*ii*) Why stripper is required ? Explain types of strippers with neat figures. [4]

(*iii*) Explain different types of locating methods and devices in jig and fixture with neat sketches. [4]

(*iv*) Write in short different types of drill bushes used in jig. [4]

Or

12. (*i*) Describe a process to Design a progressive die for Strip layout and % utilization. Centre of pressure and Press capacity. [8]

(*ii*) What are the design consideration of jig and fixture. [4]

(*iii*) Describe different types of clamping devices with neat sketches. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4957]-125

S.E. (Mechanical S/W) (Second Semester) EXAMINATION, 2016

COMPUTER APPLICATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answers to the two sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right side indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Find the real root of the equation $x^4 - x - 10 = 0$ using Newton-Raphson method to 3 decimal places, tale initial value of x as 3. [8]

(*b*) Draw flowchart for Simpson's 1/3 rule. [8]

Or

2. (*a*) Draw flowchart for False Position method. [8]

(*b*) Evaluate :

$$I = \int_0^6 \left(\frac{1}{1+x^2}\right) dx$$

using Trapezoidal rule. Take h = 1. [8]

P.T.O.

3. (*a*) Using Newton's Forward Difference Interpolation find y at $x = 45$. [8]

x	y
40	31
50	73
60	124
70	159
80	190

(*b*) Explain with suitable example Interpolation and inverse interpolation. [8]

Or

4. (*a*) Draw flowchart for Newton's Divided Difference Interpolation. [8]

(*b*) Find dy/dx and d^2y/dx^2 for $x = 1.1$ using following table : [8]

x	y
1.1	8.403
1.2	8.781
1.3	9.129
1.4	9.451
1.5	9.750

5. (*a*) Explain Partial Pivoting of simultaneous equations. [8]

(*b*) Solve the following set of simultaneous equations using Gauss Elimination Method. [10]

$$3X + 6Y + Z = 16$$

$$2X + 4Y + 3Z = 13$$

$$X + 3Y + 2Z = 9$$

Or

6. (*a*) Explain the procedure for solution of simultaneous equations using LU decomposition method. [8]

(*b*) Solve the following set of simultaneous equations using Gauss-Seidel method. [10]

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

SECTION II

7. (*a*) Determine the constant a and b by the method of least square such that $y = ae^{bx}$ fits the following data : [8]

x	***y***
2	4.077
4	11.084
6	30.128
8	81.897
10	222.62

(*b*) Draw the flowchart for Power Equation. [8]

Or

8. (*a*) The table of point is given below. Use least square method to fit a straight line to the data and find the value of $y(22)$. [8]

x	y
0	10
2	12
4	18
6	22
8	20
12	30
20	30

(*b*) Explain the following terms : [8]

(*i*) Truncation Error

(*ii*) Round-off Error

(*iii*) Relative Error

(*iv*) Inherent Error.

9. (*a*) Find out the solution of $y' = 2y + 3e^x$ using Taylor's series. Initial value are given as $x_0 = 0$. [8]

And $y_0 = 1$. Find the value of y at $x = 0.3$. Take $h = 0.1$.

(*b*) Draw the flowchart for Modified Euler's method. [8]

Or

10. (*a*) Apply Euler's method to solve :

$$y' = -xy^2,\ y(0) = 2$$

computing upto $x = 1$ with $h = 0.1$. [8]

(*b*) Draw the flowchart for Runge-Kutta fourth order method. [8]

11. (*a*) Solve :

$$(x^3 + 1)\ y'' + x^2 y' - 4xy = 2, \quad y(0) = 0,\ y(2) = 4$$

with $h = 0.5$. [10]

(*b*) Draw the flowchart for Laplace equation. [8]

Or

12. (*a*) Solve the heat equation $\frac{du}{dt} = \frac{d^2u}{dx^2}$ subjected to the condition $u(0, t) = u(1, t) = 0$ and $u(x, 0) = 2x$ for $0 \le x \le 1/2$ and $u(x, 0) = 2(1 - x)$ for $1/2 \le x \le 1$. Take $h = 1/4$ and $k = 1$. [10]

(*b*) Draw the flowchart for Poisson's equation. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4957]-132

S.E. (First Semester) (Production & Production Sandwich)

EXAMINATION, 2016

STRENGTH ANALYSIS OF MACHINE ELEMENTS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Attempt any *one* question from each Unit of Section I and Section II respectively.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Neat diagrams must be drawn wherever necessary.

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

(*vi*) Assume suitable data, if necessary.

SECTION I

UNIT-I

1. (*a*) Define yield stress and ultimate stress. [4]

(*b*) Explain the behavior of ductile material under different stress and strain conditions. [6]

P.T.O.

(*c*) Fig. 1 shows a steel bar of uniform cross section of 600 mm^2 carrying loads as shown. Determine total elongation of the bar. E = 210 GPa. [8]

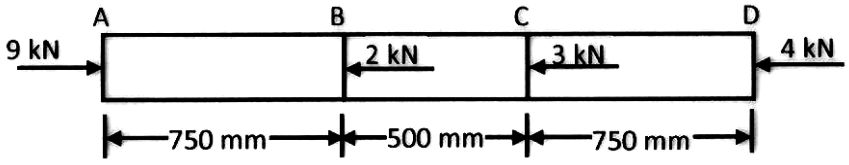


Fig. 1

Or

2. (*a*) Define factor of safety and give the significance of it. [4]

(*b*) Explain shear stress and shear strain. Derive the relation between Young's modulus, modulus of rigidity and Poisson's ratio. [6]

(*c*) The internal diameter of a hollow circular section is 40 mm and metal thickness of 4 mm. length of the member is 1.6 m. An axial pull of 52 kN is applied to the member. If E = 210 GPa and μ = 0.28, find change in length, change in internal and external diameter. [8]

UNIT-II

3. (*a*) Explain the thermal stresses and strains when : [8]

(*i*) Change in length of the bar is totally prevented

(*ii*) Change in length of the bar is partially prevented.

(*b*) A beam ABC is supported at A and B. The loading diagram for the beam ABC is as shown in Fig. 2. Construct the shear force and bending moment diagram. [8]

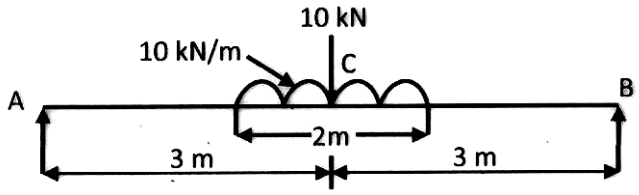


Fig. 2

Or

4. (*a*) The reinforced concrete column 500 mm × 500 mm in cross section is reinforced with four steel bars 25 mm diameter, one on each corner. The column is carrying a load of 1962 kN. Find the stresses in the concrete and the steel bars. Modulus of elasticity for steel is 206 GPa and that for concrete is 14 GPa. [8]

(*b*) Locate the point of contraflexure in the bending moment diagram shown in the Fig. 3. Also draw loading and shear force diagrams for it. [8]

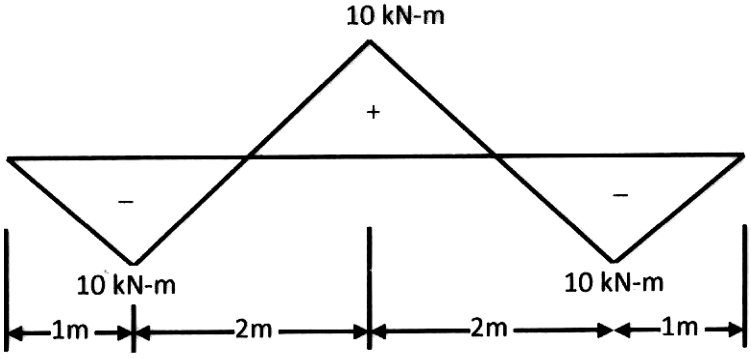


Fig. 3

UNIT-III

5. (*a*) Define moment of resistance. Give derivation for moment of resistance for a beam subjected to pure bending. [8]

(*b*) The cross section of the beam is as shown in the Fig. 4. This section is used as a beam, simply supported at ends and has span 5 m. The beam carries a uniform distributed load (UDL) of intensity 25 kN/m. Determine maximum thickness 't', if maximum bending compressive stress is not to exceed 150 MPa and maximum shear stress is not to exceed 100 MPa. [8]

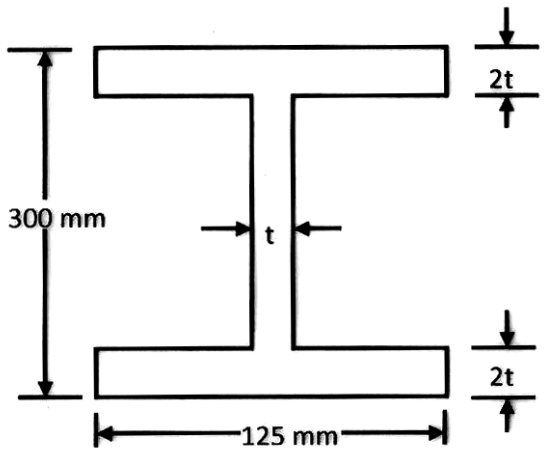


Fig. 4

Or

6. (*a*) A cast iron test beam 20 mm × 20 mm is section and 1 m long and supported at the ends fails when a central load of 640 N is applied. What uniformly distributed load will break a cantilever of same material 50 mm wide, 100 mm deep and 2 m long. [8]

(*b*) Derive shear stress distribution formula. [8]

SECTION II

UNIT-IV

7. (*a*) A bar of uniform cross section 50 mm × 75 mm is subjected to an axial tensile force of 500 kN applied at each end of the bar. Determine the maximum shearing stress existing in the bar. Also determine the normal and shearing stress acting on a plane inclined at 20° to the line of action of the axial load. [10]

(*b*) Show that in a bar, subjected to an axial load, the instantaneous stress due to sudden application of a load is twice the stress caused by the gradual application of load. [8]

Or

8. (*a*) Determine the principal stresses and location of principal planes for an element as shown in the Fig. 5. Use Mohr's circle. [10]

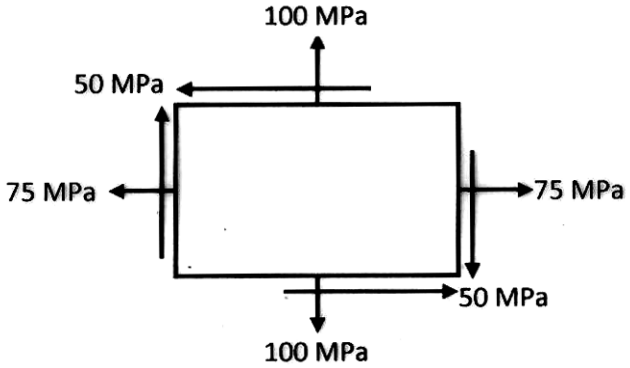


Fig. 5

(*b*) A uniform bar of cross sectional area of 700 mm^2 has a length of 2 m. Find the proof resilience and modulus of resilience if the elastic limit for the bar material is 160 MPa. Also find the maximum value of a suddenly applied load without exceeding the elastic limit. Calculate the value of gradually applied load which will produce the same extension in the bar as that produced by the suddenly applied load above. E = 210 GPa. [8]

UNIT-V

9. (*a*) A composite section of a steel rod 60 mm diameter surrounded by a closely fitting tube fixed to it. Find the outside diameter of the tube so that when a torque is applied to the composite shaft, it will be shared equally by the two materials. Take 'G' for steel as 84 GPa and G for brass as 42 GPa. If the torque is 10,000 N-m, find the maximum shearing stresses in each material and the angle of twist in a length of 4 m. [8]

(*b*) For a thin cylinder explain briefly the following : [8]

(*i*) Circumferential stress

(*ii*) Longitudinal stress

(*iii*) Change in volume.

Or

10. (*a*) Derive an expression for the polar moment of inertia for solid and hollow circular section. [8]

(*b*) Calculate the circumferential and longitudinal strains for a boiler of 1000 mm diameter when it is subjected to an internal pressure of 2 MPa. The wall thickness is such that the maximum tensile stress in the shell material is limited to 50 MPa.

Take E = 200 GPa and μ = 0.25. [8]

UNIT-VI

11. (*a*) Explain the Maculay's method for uniformly distributed load. [8]

(*b*) Define slenderness ratio. For a mild steel column hinged at both the ends, determine limiting value of slenderness ratio below which Euler's formula does not apply. Stress in compression is 200 MPa and Young's modulus is 200 GPa. [8]

Or

12. (*a*) A simple beam AB supports two concentrated loads 100 kN and 200 kN as shown in Fig. 6. Calculate the maximum deflection of beam, if E = 200 GPa, I = 1.2×10^9 mm^4. [8]

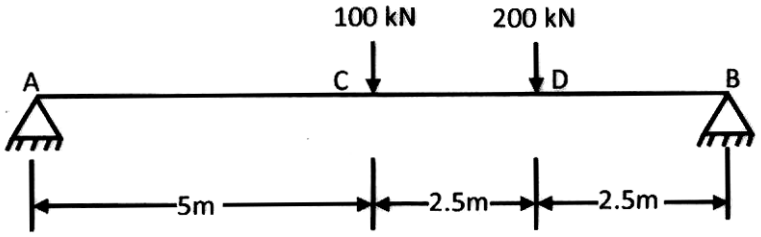


Fig. 6

(*b*) What is buckling load, crushing load and equivalent length of column. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**3**

Seat No.	

[4957]-133

S.E. (Production/Industrial) (First Semester)

EXAMINATION, 2016

MACHINE TOOL OPERATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Solve *three* questions from each section.

(*ii*) Use separate answer sheets for each Section.

(*iii*) Assume suitable data, if necessary.

Section I

1. (*a*) List various Taper turning methods and explain any three Taper turning methods lathe with suitable sketches. [10]

(*b*) Explain working of back gear mechanism with suitable sketch. [8]

OR

2. (*a*) Explain working of Tailstock with suitable sectional view. [8]

(*b*) Discuss various types of mandrel with suitable sketches. [10]

3. (*a*) Explain working of sensitive drilling machine with suitable sketch. [8]

(*b*) List operations which can be performed on drilling machine and explain any *three* with suitable sketches. [8]

P.T.O.

OR

4. (*a*) With suitable sketch, explain construction and working of floating holder assembly. [8]

(*b*) Compare gang drilling machine and multiple spindle drilling machine. [8]

5. (*a*) List various standard milling cutters and explain any three with suitable sketches. [8]

(*b*) Explain use of compound indexing with suitable example. [8]

OR

6. (*a*) List various types of milling machines and explain working of column and knee type milling machine with suitable sketch. [8]

(*b*) With suitable sketch, explain construction and working of Universal dividing head. [8]

Section II

7. (*a*) Explain crank and slotted link used in Shaper with suitable sketch. [10]

(*b*) Discuss advantages and limitations of broaching. [8]

OR

8. (*a*) Discuss various types of Broaching machines on the basis of method of operation. [10]

(*b*) Explain working of hydraulic shaper mechanism with suitable sketch. [8]

9. (*a*) Discuss type sof shapes used in grinding wheels. [8]

(*b*) Explain Tool and Cutter Grinder with suitable sketch. [8]

OR

10. (*a*) Discuss different types of bonds used in grinding wheels. [8]

(*b*) Explain glazing and loading in grinding wheels. [8]

11. (*a*) Explain Honing and Superfinishing with suitable sketches. [8]

(*b*) Explain : [8]

(*i*) Tumbling

(*ii*) Electroplating.

OR

12. Write short notes on the following : [16]

(*i*) Metal spraying

(*ii*) Lapping

(*iii*) Buffing.