

**B.L.D.E.ASSOCIATION V.P.Dr.P.G.HALAKATTI COLLEGE OF
ENGINEERING AND TECHNOLOGY, VIJYAPUR 586-103**

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Feb-Mar 2022

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CBCS SCHEME

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18AU33

Third Semester B.E. Degree Examination, Feb./Mar. 2022 Material Science and Metallurgy

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define atomic packing factor. Determine and show that APF of FCC crystal structure is higher than that of BCC crystal structure. (10 Marks)
b. State and explain Fick's First law of diffusion. (06 Marks)
c. List the mechanisms of diffusion in solids and explain any two with neat sketches. (04 Marks)

OR

- 2 a. Draw the stress-strain diagram for a mild steel material. Explain how the following properties are determined with the help of stress-strain diagram:
(i) Ductility
(ii) Yield strength
(iii) UTS (10 Marks)
b. Explain plastic deformation of single crystal by slip and twinning with neat sketches. (06 Marks)
c. Define True Stress and True Strain. (04 Marks)

Module-2

- 3 a. Define fracture. Explain Cup and Cone fracture with a neat diagram. (08 Marks)
b. Define Creep. With a typical creep curve, explain the different stages of creep. (08 Marks)
c. Explain creep properties. (04 Marks)

OR

- 4 a. Define fatigue. Explain with a neat sketch, RR Moore Bending fatigue test and S-N curve. (10 Marks)
b. Explain the different types of fatigue loading with examples. (06 Marks)
c. Explain fatigue properties. (04 Marks)

Module-3

- 5 a. Define Homogeneous and Heterogenous nucleation. Explain in brief. (08 Marks)
b. Explain different types of solid solutions with suitable sketches. (06 Marks)
c. State and explain Hume-Rothery's rule for the formation of substitutional solid solutions. (06 Marks)

OR

- 6 a. Describe the construction of phase diagram by a thermal analysis method. (08 Marks)
b. State Gibb's phase rule. Define the terms phases component and degree of freedom. (06 Marks)
c. Draw peritectic phase diagram and write the peritectic reaction. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Draw the TTT diagram for eutectoid steel and explain different microstructures. (08 Marks)
b. Define hardenability. Explain Jominy End Quench test of measuring hardenability. (06 Marks)
c. Explain flame hardening and induction hardening process with suitable sketches. (06 Marks)

OR

- 8 a. Explain properties, composition and uses of Grey Cast Iron, S.G. Iron and Steel. (10 Marks)
b. Write short note on age hardening of (i) Copper alloys (ii) Aluminium alloys (10 Marks)

Module-5

- 9 a. Define composite materials. Describe the role of matrix and reinforcement in composite materials. (08 Marks)
b. Explain pultrusion process for the production of FRP's with a neat sketch. (06 Marks)
c. What are the advantages and applications of composite materials? (06 Marks)

OR

- 10 a. Write short notes on:
(i) Brasses and Bronzes (10 Marks)
(ii) Al-Cu and Al-Si (10 Marks)
b. List the advantages, disadvantages and applications of non ferrous metals. (10 Marks)

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Third Semester B.E. Degree Examination, Feb./Mar. 2022 Mechanics of Materials

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define :
- i) Modulus of rigidity ii) Bulk modulus iii) Volumetric strain
iv) Poisson's ratio v) Hooke's law. (10 Marks)
- b. Determine the stresses in various segment of the circular bar shown in Fig Q1(b). Compute the total elongation taking Young's modulus to be 195GPa.

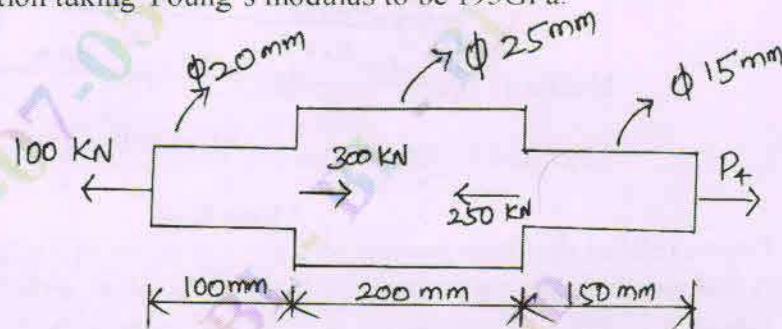


Fig Q1(b)

(10 Marks)

OR

- 2 a. Derive the relationship between Young's modulus and modulus of rigidity. (10 Marks)
- b. A steel rod 15m long at a temperature of 15°C. Find the free expansion of length when the temperature is raised to 65°C. Find the temperature stresses produced, when
- i) The expansion of the rod is prevented
ii) The rod is permitted to expand by 6mm
- Take $\alpha = 12 \times 10^{-6}$ per °C and $E = 2 \times 10^5$ N/mm². (10 Marks)

Module-2

- 3 a. Derive the construction of Mohr's circle for plane stress. (10 Marks)
- b. Derive an expression for normal stress and shear stress on an oblique plane inclined at an angle ' θ ' with vertical axis for two dimensional stress system. (10 Marks)

OR

- 4 a. Explain the concept of circumferential stress and longitudinal stress corresponding to thin cylinder. (10 Marks)
- b. A pipe of 500mm external diameter and 75mm thick is filled with a fluid at a pressure of 6N/mm². Find the maximum and minimum hoop stress across the cross section of the cylinder. Also sketch the radial pressure and hoop stress distribution. (10 Marks)

Module-3

- 5 a. Derive the deflection equation $EI \frac{d^2y}{dx^2} = M$. (10 Marks)
- b. A simply supported beam of span 6m is subjected to a concentrated load of 25kN acting at a distance of 2m from the left end. Also subjected to an uniformly distributed load of 10kN/m over the entire span. Draw the bending moment and shear force diagram indicating maximum and minimum values. (10 Marks)

OR

- 6 a. Write down the assumption in simple bending. (08 Marks)
- b. Draw shear force and bending moment diagram as shown in Fig. Q6(b) indicating the principal values.

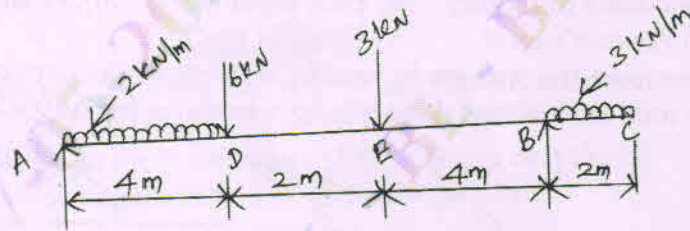


Fig. Q6(b)

(12 Marks)

Module-4

- 7 a. Derive relationship between torque and shear stress in a solid circular shaft. (10 Marks)
- b. A hollow shaft having internal diameter 40% of its external diameter, transmits 562.5kW power at 100rpm. Determine the internal and external diameter of the shaft if the shear stress is not exceed 60N/mm^2 and the twist in a length of 2.5m should not exceed 1.3 degrees. The maximum torque being 25% greater the mean modulus of rigidity $= 9 \times 10^4 \text{N/mm}^2$. (10 Marks)

OR

- 8 a. Derive an expression for Euler's crippling load for a column when one end is fixed and other end free. (10 Marks)
- b. A solid round bar of 60mm diameter and 2.5m is used as strut. Find the safe compressive load for the strut if i) Both ends are hinged ii) Both ends are fixed. Take $E = 2 \times 10^5 \text{N/mm}^2$ and Factor of safety = 3. (10 Marks)

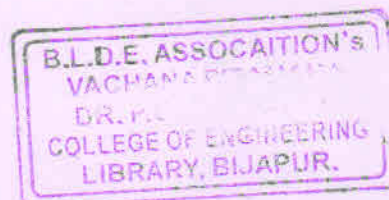
Module-5

- 9 a. Determine the internal strain energy stored within an elastic bar subjected to an axial tensile Force F. (10 Marks)
- b. A cantilever beam of uniform across section carries a point load at the free end. Determine :
i) Strain energy stored by the cantilever beam and deflection at the free end
ii) If the load $F = 200\text{kN}$, $E = 2 \times 10^8 \text{kN/m}^2$, $\ell = 3\text{m}$, $I = 10^{-3} \text{m}^4$. Determine the above. (10 Marks)

OR

- 10 a. Explain: i) Maximum principal stress theory ii) Maximum shear stress theory. (10 Marks)
- b. A Bolt is under an axial pull of 9.6kN together with a shear force of 4.8kN. If the factor of safety is 3, yield strength of bolt. Material is 270N/mm^2 and Poisson ratio is 0.3. Determine the diameter of bolt using maximum plane stress theory. (10 Marks)

2 of 2



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18AU35

Third Semester B.E. Degree Examination, Feb./Mar. 2022 Mechanical Measurement and Metrology

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define : i) Accuracy ii) Precision iii) Sensitivity
iv) Hysteresis v) Repeatability. (10 Marks)
- b. Classify errors, explain any two errors with neat diagram (if required). (10 Marks)

OR

- 2 a. Explain : i) Linearity ii) Time delay iii) Threshold
iv) Loading effect v) Calibration. (10 Marks)
- b. Write the comparison between Line standard and End standard. (10 Marks)

Module-2

- 3 a. With a neat diagram explain Solex comparator. (10 Marks)
- b. With a neat diagram explain Sigma comparator. (10 Marks)

OR

- 4 a. With a neat diagram explain the principle, construction and working of sine bar. (10 Marks)
- b. With a neat diagram explain Clinometer. (10 Marks)

Module-3

- 5 a. Name different mechanical transducer and with a neat diagram explain any one. (10 Marks)
- b. With a neat diagram explain Piezo-Electric transducer. (10 Marks)

OR

- 6 a. With a neat diagram explain Cathode-Ray oscilloscope. (10 Marks)
- b. With a neat diagram explain xy plotter. (10 Marks)

Module-4

- 7 a. With a neat sketch explain analytical balance. (10 Marks)
- b. With a neat sketch explain Prony brake dynamometer. (10 Marks)

OR

- 8 a. With a neat diagram explain eddy current dynamometer. (10 Marks)
- b. Explain preparation and mounting of strain gauge. (10 Marks)

Module-5

- 9 a. Name the types of fits and explain them. (10 Marks)
- b. Name the different ways in which the mating parts can be assembled together and explain any two types. (10 Marks)

OR

- 10 a. With a neat diagram explain McLeod gauge. (10 Marks)
- b. With a neat diagram explain optical pyrometer. (10 Marks)

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18MAT31

Third Semester B.E. Degree Examination, Feb./Mar. 2022 Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Evaluate (i) $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$ (ii) $L(t^2 e^{-3t} \sin 2t)$ (06 Marks)
- b. If $f(t) = \begin{cases} t, & 0 \leq t \leq a \\ 2a - t, & a \leq t \leq 2a \end{cases}$, $f(t + 2a) = f(t)$ then show that $L(f(t)) = \frac{1}{s^2} \tanh\left(\frac{as}{2}\right)$ (07 Marks)
- c. Solve by using Laplace Transforms (07 Marks)
- $$\frac{d^2 y}{dt^2} + 4 \frac{dy}{dt} + 4y = e^{-t}, y(0) = 0, y'(0) = 0$$

OR

- 2 a. Evaluate $L^{-1}\left(\frac{4s+5}{(s+1)^2(s+2)}\right)$ (06 Marks)
- b. Find $L^{-1}\left(\frac{s}{(s^2+a^2)^2}\right)$ by using convolution theorem. (07 Marks)
- c. Express $f(t) = \begin{cases} \sin t, & 0 \leq t < \pi \\ \sin 2t, & \pi \leq t < 2\pi \\ \sin 3t, & t \geq 2\pi \end{cases}$ (07 Marks)
- in terms of unit step function and hence find its Laplace Transform.

Module-2

- 3 a. Obtain fourier series for the function $f(x) = |x|$ in $(-\pi, \pi)$ (06 Marks)
- b. Expand $f(x) = \frac{(\pi-x)^2}{4}$ as a Fourier series in the interval $(0, 2\pi)$ and hence deduce that (07 Marks)
- $$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$$
- c. Express y as a Fourier series upto the second harmonic given :

x:	0	60	120	180	240	300
y:	4	3	2	4	5	6

(07 Marks)

OR

- 4 a. Find the Half-Range sine series of $\pi x - x^2$ in the interval $(0, \pi)$ (06 Marks)
- b. Obtain fourier expansion of the function $f(x) = 2x - x^2$ in the interval $(0, 3)$ (07 Marks)

- c. Obtain the Fourier expansion of y upto the first harmonic given :

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(07 Marks)

Module-3

- 5 a. If $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$, find the Fourier transform of $f(x)$ and hence find the

value of $\int_0^{\infty} \frac{\sin x}{x} dx$

(06 Marks)

- b. Find the infinite Fourier cosine transform of e^{-4x} . (07 Marks)
 c. Solve using z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0, y_1 = 2$ (07 Marks)

OR

- 6 a. Find the fourier sine transform of $f(x) = e^{-|x|}$ and

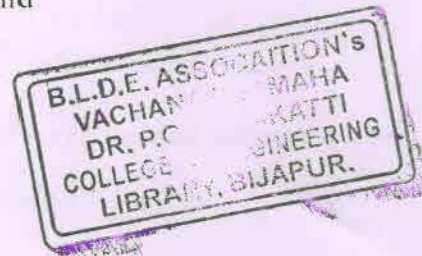
hence evaluate $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx ; m > 0$.

(06 Marks)

- b. Obtain the z-transform of $\cos n\theta$ and $\sin n\theta$. (07 Marks)
 c. Find the inverse z-transform of

$$\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$$

(07 Marks)

**Module-4**

- 7 a. Solve $\frac{dy}{dx} = x^3 + y$, $y(1) = 1$ using Taylor's series method considering up to fourth degree terms and find $y(1.1)$. (06 Marks)
 b. Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ compute $y(0.2)$ by taking $h = 0.2$ using Runge - Kutta method of fourth order. (07 Marks)
 c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040$ and $y(0.3) = 2.090$, find $y(0.4)$ correct to 4 decimal places using Adams-Bashforth method. (07 Marks)

OR

- 8 a. Use fourth order Runge-Kutta method, to find $y(0.8)$ with $h = 0.4$, given $\frac{dy}{dx} = \sqrt{x+y}$, $y(0.4) = 0.41$ (06 Marks)
 b. Use modified Euler's method to compute $y(20.2)$ and $y(20.4)$ given that $\frac{dy}{dx} = \log_{10} \left(\frac{x}{y} \right)$ with $y(20) = 5$ Taking $h = 0.2$. (07 Marks)
 c. Apply Milne's predictor-corrector formulae to compute $y(2.0)$ given $\frac{dy}{dx} = \frac{x+y}{2}$ with

x	0.0	0.5	1.0	1.5
y	2.000	2.6360	3.5950	4.9680

(07 Marks)

Module-5

9. a. Using Runge-Kutta method, solve

$$\frac{d^2y}{dx^2} = x \left(\frac{dy}{dx} \right)^2 - y^2, \text{ for } x = 0.2, \text{ correct to four decimal places, using initial conditions } y(0) = 1, y'(0) = 0 \quad (07 \text{ Marks})$$

- b. Derive Euler's equation in the standard form viz,
- $\frac{\partial f}{\partial y} - \frac{d}{dx} \left(\frac{\partial f}{\partial y'} \right) = 0 \quad (07 \text{ Marks})$

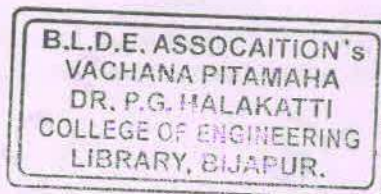
- c. Find the extremal of the functional
- $\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x) dx \quad (06 \text{ Marks})$

OR

10. a. Given the differential equation
- $2 \frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$
- and the following table of initial values:

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y'	2	2.3178	2.6725	2.0657

- Compute $y(1.4)$ by applying Milne's Predictor-corrector formula. (07 Marks)
- b. Prove that geodesics of a plane surface are straight lines. (07 Marks)
- c. On what curves can the functional $\int_0^1 (y'^2 + 12xy) dx$ with $y(0) = 0, y(1) = 1$ can be extremized? (06 Marks)



CBCS SCHEME

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18AU51

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022 Management and Entrepreneurship

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define Management. Briefly explain the different levels and skills required at different Management levels. (10 Marks)
b. Explain briefly the various functions of Management. (10 Marks)

OR

- 2 a. Briefly explain the Hierarchy of plans with relevant diagram. (10 Marks)
b. Discuss briefly the various steps involved in the Planning process. (10 Marks)

Module-2

- 3 a. Briefly explain the steps involved in the recruitment and selection process. (10 Marks)
b. List and explain the essentials of Sound Control System. (10 Marks)

OR

- 4 a. What is Controlling? Discuss the steps in a control process. (10 Marks)
b. Explain the Maslow's theory of motivation, with a neat diagram. (10 Marks)

Module-3

- 5 a. Define the term Entrepreneur. Explain the functions of an Entrepreneur. (10 Marks)
b. Explain the types of Entrepreneur. (10 Marks)

OR

- 6 a. Briefly compare Entrepreneurs and Managers. (05 Marks)
b. List and explain the characteristics of an Entrepreneur. (05 Marks)
c. Explain the various stages in Entrepreneurial Process. (10 Marks)

Module-4

- 7 a. Define "Small Scale Industry (SSI)" and state the characterisation and objectives of SSI. (10 Marks)
b. Explain the steps involved in setting up a Small Scale Industries (SSI). (10 Marks)

OR

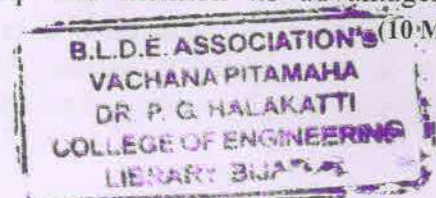
- 8 a. What are the objectives and functions of DIC and NSIC? (10 Marks)
b. Explain the objective and functions of KSFC and SISI / MSME. (10 Marks)

Module-5

- 9 a. What is the meaning of a "Project"? State and explain the objectives of Projects. (05 Marks)
b. Write various points / factors to be considered for Project identification. (05 Marks)
c. Explain in detail the contents of "Project Report". (10 Marks)

OR

- 10 a. Write the characteristics of Partnership firm and list its advantages and disadvantages. (10 Marks)
b. Explain briefly the features of Sole proprietorship and mention its advantages and disadvantages. (10 Marks)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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18AU52

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022

Dynamics of Machines

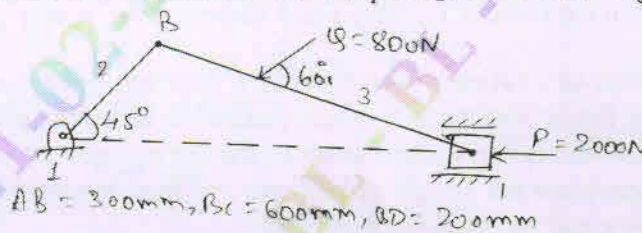
Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

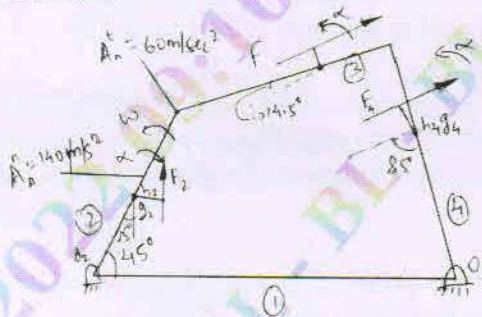
- 1 a. Explain the analysis of engine mechanism with suitable figure. (06 Marks)
 b. Determine the various forces on the links and couple T_2 as shown in Fig.Q1(b).



(14 Marks)

OR

- 2 The four bar mechanism is shown in Fig.Q2. The centre of gravity of each link is at its mid point. Length of links : $O_2O_4 = 500\text{mm}$, $O_2A = 250\text{mm}$, $O_4B = 300\text{mm}$, $AB = 300\text{mm}$. Mass of the links $O_2A = 1.52\text{kg}$, $AB = 3.06\text{kg}$, $O_2B = 5.09\text{kg}$. Mass moment of inertia of links : $O_2A = 0.012\text{kgm}^2$, $AB = 0.036\text{kgm}^2$, $O_4B = 0.02\text{kgm}^2$. Find the inertia forces on each link.



(20 Marks)

Module-2

- 3 a. A, B, C and D are 4 masses carried by a rotating shaft at radius 100, 125, 200 and 150mm, respectively. The planes in which the masses revolve are spaced 600mm apart and the masses B, C and D are 10, 5, 4kg respectively. Find the required mass A and the relative angular positions of the 4 masses to keep the shaft in balance. (14 Marks)
 b. Describe the static and dynamic balancing. (06 Marks)

OR

- 4 A 5 cylinder inline engine running at 500 rpm has successive cranks at 144° apart. The distance between the cylinder center line is 300mm. Piston stroke = 240mm, Length of CR = 480mm. Examine the engine for balance of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these maximum values occur. The reciprocating mass for each cylinder position of central crank at which these maximum values occur. The reciprocating mass for each cylinder is 150N. (20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-3

- 5 a. The TMD for a four stroke gas engine may be assumed for simplicity to be represented by 4 triangles and areas of which from the line of zero pressure are as follows :
Expansion = 35.5cm^2 , section = 3.5cm^2 , Exhaust = 5cm^2 , Compression = 14cm^2 ,
 $1\text{cm}^2 = 295\text{ Nm}$. Assuming the resisting moment to be uniform. Find the mass of the rim of the flywheel required to keep the mean speed 200rpm within $\pm 2\%$ of the mean speed. Radius of the rim = 75cm. (14 Marks)
- b. Explain the relationship between e_{max} , K_S and l . (06 Marks)

OR

- 6 a. Derive an expression for speed and height of the porter governor by instantaneous method. (10 Marks)
- b. The radius of rotation of the balls of a Hartwell governor is 8cm at the minimum speed of 300rpm. Neglecting gravity effect determine the speed after the sleeve is lifted by 6cm, also determine the initial compression of the spring, governor effort and power. The particulars of the governor are length of ball arm = 15cm, length of sleeve arm = 10cm, mass of each ball = 4kg and stiffness = 25000N/m. (10 Marks)

Module-4

- 7 a. Describe the laws of solid friction. (07 Marks)
- b. Derive an expression for total frictional torque of flat collar bearing considering uniform pressure and uniform wear. (13 Marks)

OR

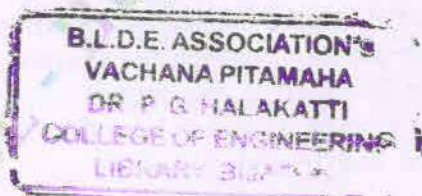
- 8 a. Derive an expression for effect of centrifugal tension. (10 Marks)
- b. Derive an expression for ratio of belt tensions. (10 Marks)

Module-5

- 9 a. Derive an expression for stability of a two wheel vehicle. (12 Marks)
- b. Describe Gyroscopic couple with suitable figure and expression. (08 Marks)

OR

- 10 Derive an expression for displacement, velocity and acceleration of follower when the roller is in contact with straight flank. (20 Marks)



CBCS SCHEME

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18AU54

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022 Automotive Fuels and Combustion

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the following energy sources with sketch i) Solar energy ii) Wind energy. (10 Marks)
b. What is fuel cell? With a neat sketch explain the working of fuel cells. (10 Marks)

OR

- 2 a. Explain the following properties of fluid :
i) Specific gravity
ii) Calorific value
iii) Annealing point
iv) Diesel index
v) Vapour pressure. (10 Marks)
b. Explain the refining process of petroleum with a neat sketch. Mention the products produced. (10 Marks)

Module-2

- 3 a. Explain the rating of S.I and C.I engine fuels. (10 Marks)
b. What are the properties of good air fuel mixture? Explain. (10 Marks)

OR

- 4 a. Explain the flue gas analysis by gas chromatography with a neat sketch. (10 Marks)
b. Find the stoichiometric A/F ratio for the combustion of the ethyl alcohol C_2H_6O in a petrol engine. Calculate the A/F ratio for a mixture strength of 80% and determine the wet and dry analysis by volume at exhaust gas. (10 Marks)

Module-3

- 5 a. Explain combustion stages in S.I. engine. (10 Marks)
b. List the different types of combustion chamber. Explain anyone with a neat sketch. (10 Marks)

OR

- 6 a. Discuss the various stages of combustion in C.I. engine with neat P-Q diagram. (10 Marks)
b. With a neat sketch illustrate the concept of delay period in C.I. engine. (10 Marks)

Module-4

- 7 a. Explain rope brake dynamometer with a neat sketch. (10 Marks)
b. A gasoline engine working on 4 stroke develops a brake power of 20.9KW. A Morse test was conducted on this engine and the brake power (KW) obtained when each cylinder was made in operative by short circuiting the spark plug are 14.9, 14.3, 14.8 and 14.5 respectively. The test was conducted at constant speed. Find the indicated power, mechanical efficiency and brake mean effective pressure when all the cylinders are firing. The bore of the engine is 75mm and the stroke is 90mm. The engine is running at 3000rpm. (10 Marks)

OR

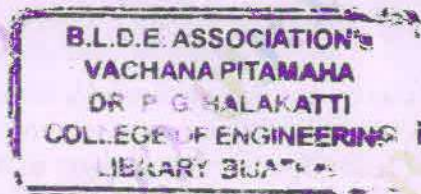
- 8 a. Explain retardation test and derive the equation for same. (10 Marks)
- b. An 8 cylinder, 4 stroke engine at 9cm bore and 8cm stroke with a compression ratio of 7 is tested at 4500rpm on a dynamometer which has 54cm arm. During a 10 minutes test the dynamometer scale reading has 42kg and engine consumed 4.4kg of gasoline having a calorific value of 44000kJ/kg. Air 27°C and 1 bar was supplied to the carburetor at the rate of 6 kg/min. Find :
- Brake power
 - Brake mean effective pressure
 - Brake specific fuel consumption
 - Brake thermal efficiency
 - Volumetric efficiency
 - A/F ratio.
- (10 Marks)

Module-5

- 9 a. Discuss the working of a dual fuel engine. State its advantages and disadvantages. (10 Marks)
- b. Discuss any four factors affecting combustion in dual fuel engine. (10 Marks)

OR

- 10 a. What are the modification required to use CNG as fuel in diesel engine. (10 Marks)
- b. Outline the requirement of multi-fuel engine modification. (10 Marks)



CBCS SCHEME

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18AU55

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022 Automotive Transmission

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Sketch and explain the construction and working of centrifugal clutch. (10 Marks)
- b. What is the need of a clutch? What are the requirements of a good clutch? (10 Marks)

OR

- 2 a. Explain the construction and working of single plate clutch. (10 Marks)
- b. List out the clutch troubles and give appropriate reasons. (10 Marks)

Module-2

- 3 a. With a neat sketch, explain the construction and working principle of a fluid flywheel. (10 Marks)
- b. With a neat sketch, explain the construction and working principle of a single stage torque converter. (10 Marks)

OR

- 4 a. Discuss with a neat sketch the construction features and working of over running clutch. (10 Marks)
- b. Define torque converter. Explain the working of multistage torque converter with neat sketch. (10 Marks)

Module-3

- 5 a. Briefly discuss the various resistance to motion of the automobile. (10 Marks)
- b. Describe the variation of tractive effort and total resistance with the speed of the vehicle with the help of graph. (10 Marks)

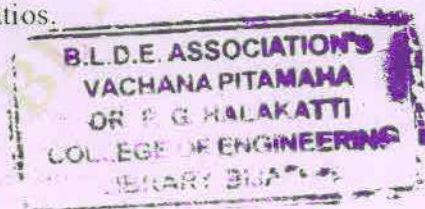
OR

- 6 a. Draw a neat sketch and explain the construction and working of synchromesh unit used in gear box. (10 Marks)
- b. Sketch and explain the working principle of 3 speed constant Mesh gear box. (10 Marks)

Module-4

- 7 a. Sketch and explain the working principle of overdrive and also mention its advantages. (10 Marks)
- b. With a neat sketch, explain the construction and working of Wilson gear box for various gear ratios. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. $42+8=50$, will be treated as malpractice.



OR

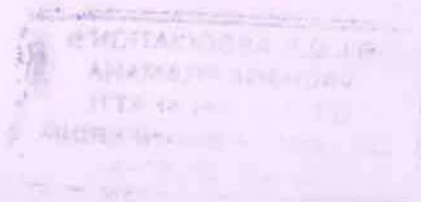
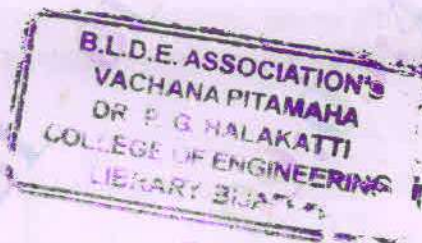
- 8 a. Briefly explain the principle of simple epicyclic gear train with sketch. Show that more number of gear ratio are possible from it. (10 Marks)
- b. The input shaft of an epicyclic type of gearbox has two sun wheels each with 25 teeth splined to the shaft. Their corresponding annuli have 100 teeth each. The output shaft has a sun running free on that shaft with 40 teeth, while the corresponding annulus has 80 teeth. Calculate, the first, second and reverse gear ratios. (10 Marks)

Module-5

- 9 a. With a neat sketch, explain the working principle of variable displacement pump. (10 Marks)
- b. What are the limitation and advantages of hydrostatic drives? (10 Marks)

OR

- 10 a. With a neat diagram, explain the working of Borg Warner automatic transmission system. (10 Marks)
- b. Discuss the functions of the hydraulic control in an epicyclic planetary gear system. (10 Marks)



CBCS SCHEME



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18AU56

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022 Hydraulics and Pneumatics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define hydraulic system. State advantages and limitations of hydraulic system. (10 Marks)
b. Explain variable displacement axial piston pump (swash plate) with neat sketch. (10 Marks)

OR

- 2 a. Define and classify actuator. With a neat sketch, explain working of vane type motor. (10 Marks)
b. What is the need of lever system? With neat sketch and example, explain three types of lever system. (10 Marks)

Module-2

- 3 a. With a neat sketch, explain pilot operated direction control valve. (10 Marks)
b. With a neat sketch, explain working of pressure sequence valve. (10 Marks)

OR

- 4 a. Explain any five properties of a good hydraulic fluid. (10 Marks)
b. With a neat sketch, explain Reservoir System. State the functions. (10 Marks)

Module-3

- 5 a. With a neat sketch, explain working of pump unloading circuit. (10 Marks)
b. Explain the working of single and double acting cylinder with suitable circuit. (10 Marks)

OR

- 6 a. Discuss the speed control of hydraulic cylinder using meter out circuit. (10 Marks)
b. Define accumulator. Explain the following with neat sketch:
(i) Spring loaded accumulator
(ii) Piston type separator accumulator (10 Marks)

Module-4

- 7 a. Explain the characteristics of compressed air. (10 Marks)
b. With a neat sketch and graphical symbol, explain end position cushioning in cylinder. (10 Marks)

OR

- 8 a. Explain the working of 3/2 poppet valve with a neat sketch. (10 Marks)
b. Explain the quick exhaust valve with neat sketch and circuit diagram. (10 Marks)

Module-5

- 9 a. With circuit diagram, explain pilot assisted solenoid control DC valve. (08 Marks)
b. Explain cascade method of pneumatic circuit design. (12 Marks)

OR

- 10 a. With neat sketch, write a note on: (i) Solenoid (ii) Limit switches (10 Marks)
b. Explain the following with neat sketch: (i) Relay (ii) Motion diagram (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

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Fifth Semester B.E. Degree Examination, Feb./Mar.2022 Design of Machine Elements – I

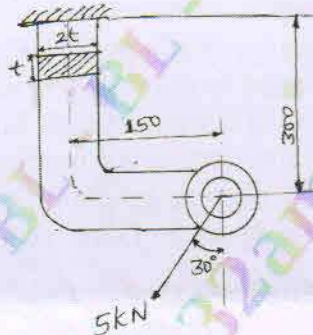
Time: 3 hrs.

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. Missing data if any may be suitably assumed.
 3. Use of design data hand book is permitted.

Module-1

- 1 a. Mention the steps and explain clearly design procedure. (06 Marks)
 b. A bracket with rectangular cross section shown in Fig. Q1 (b) is subjected to a force of 5 kN acting at an angle of 30° to the vertical as shown in Fig. Q1 (b). Determine the dimensions of the bracket, taking the material as FG200 cast iron with ultimate stress, $\sigma_u = 200 \text{ N/mm}^2$ and factor of safety 3.5.



All dimensions are in mm

Fig. Q1 (b)

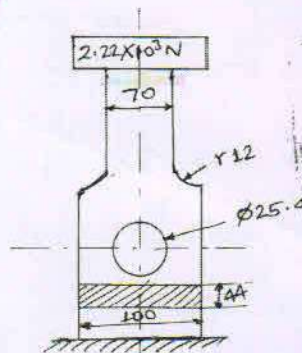
(14 Marks)

OR

- 2 a. Mention and explain various, theories of failure. (06 Marks)
 b. A mild steel shaft of 60 mm diameter is subjected to bending moment of $25 \times 10^5 \text{ N-mm}$ and torque 'T'. If the yield stress in tension is 300 N/mm^2 . Find the maximum value of torque according to, (i) Maximum principal stress theory. (ii) Maximum shear stress theory. (iii) Maximum distortion energy theory. Take FOS as 1.5. (14 Marks)

Module-2

- 3 a. Derive an expression for impact stress due to axial loading. (05 Marks)
 b. Find the value of FOS of the part as shown in Fig. Q3 (b). It is made of SAE 1045 annealed steel. Find the value of FOS if the same part is made of cast iron, $\sigma_y = 310 \text{ N/mm}^2$ for SAE1045 steel and $\sigma_u = 552 \text{ N/mm}^2$ for cast iron.



All dimensions are in mm Fig. Q3 (b)

1 of 4

(15 Marks)



OR

- 4 a. Derive an expression for Soderberg criteria.
b. A steel member of circular cross section is subjected to a torsional stress that varies from 0 – 35 MPa and at the same time it is subjected to an axial stress that varies from -14 MPa to 28 MPa. Neglecting the stress concentration and column effect and assuming that the maximum stress in torsion and axial load occurs at the same time. Determine maximum equivalent shear stress and the FOS based upon shear. Material has an endurance limit of 206 MPa and yield stress 408 MPa. The diameter of member is 12 mm. Take correction factor as 1 and surface finish factor as 1. (15 Marks)

Module-3

- 5 a. A square key is used to key a gear and a shaft of diameter 35 mm. The hub length of the gear is 60 mm, both key and shaft is made of same material having allowable shear stress of 55 MPa. What are the dimensions of the key according to maximum stress theory if 395 N-m of torque is to be transmitted? (06 Marks)
b. Design a cotter joint for the following specification. Axial thrust 100 kN. Allowable stresses are, (i) Tensile stress 100 MPa (ii) Shear stress 60 MPa (iii) Crushing stress 120 MPa. (14 Marks)

OR

- 6 A uniform circular carbon steel shaft made of SAE 1025 annealed is mounted on two bearings 850 mm apart as shown in the Fig. Q6. The shaft carries a gear A at 200 mm to the right of the left bearing and a pulley B at 250 mm to left of the right bearing. The gear is subjected to horizontal force of 3500 N and a vertical upward force of 9600 N. The pulley is driven by a belt with a tension on tight side to be 6000 N and on the slack side to be 2000 N. The shock and fatigue factors for bending and torsion as $K_m = 2$ and $K_t = 1.5$ respectively and weight of the pulley to be 1500 N. Design the diameter of the shaft for yield stress taking factor of safety as 3. Draw neatly the sketch with loading and bending moment diagram.

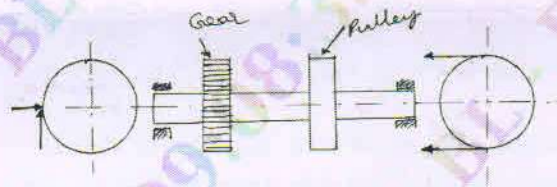


Fig. Q6

(20 Marks)

Module-4

- 7 a. A double riveted double covered butt joint 20 mm plate thickness is made with 25 mm rivet at 100 mm pitch. Permissible stresses are, $\sigma_t = 120 \text{ N/mm}^2$, $\tau = 100 \text{ N/mm}^2$, $\sigma_c = 150 \text{ N/mm}^2$. Find the efficiency of the joint. (10 Marks)
b. A bracket is riveted to a column by 6 rivets of equal size as shown in Fig. Q7 (b). It carries a load of 60 kN at a distance of 200 mm from the centre of the column. If the maximum shear stress in the rivet is limited to 150 N/mm^2 . Determine the diameter of rivet.

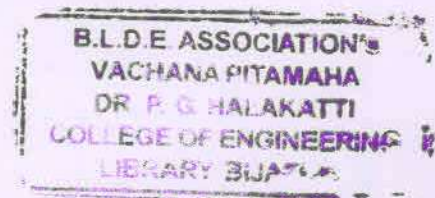
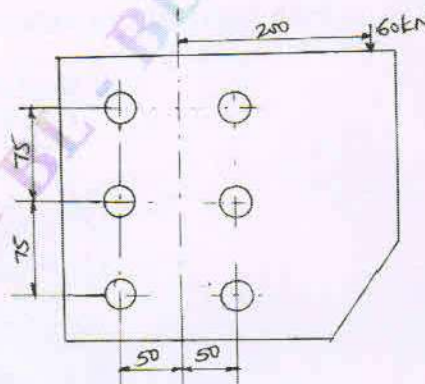
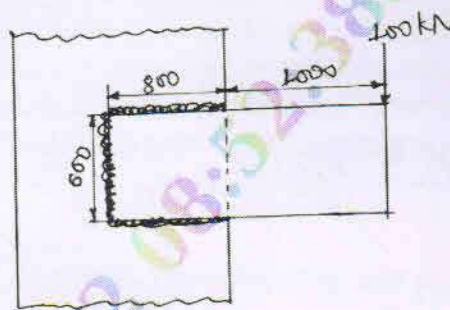


Fig. Q7 (b)

(10 Marks)

OR

- 8 a. Determine the size of the fillet weld required for the flat plate loaded as shown in Fig. Q8 (a). Take allowable shear stress for the weld material as 60 MPa.

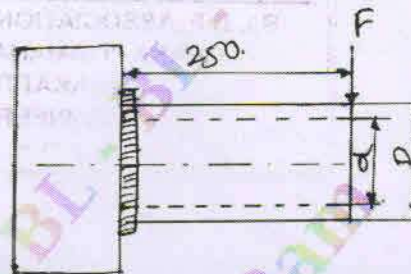


All dimensions are in mm

Fig. Q8 (a)

(10 Marks)

- b. A hollow pipe of outside diameter 100 mm and inside diameter 80 mm is welded to a column as shown in Fig. Q8 (b). Determine the size of the weld, if the stress in the weld and the pipe are to be equal, determine also the load that can be applied at the free end of the pipe assuming the stress allowable as 98 MPa.



Dimensions are in mm

Fig. Q8 (b)

(10 Marks)

Module-5

- 9 a. The structural connection shown in Fig. Q9 (a) is subjected to an eccentric load F of 10 kN with an eccentricity of 500 mm. The centre distance between bolts at 1 and 3 is 150 mm and the centre distance between bolts at 1 and 2 is 200 mm. All bolts are identical. The bolts are made of plain carbon steel having yield strength in tension of 400 MPa and the FOS = 2.5. Determine the size of the bolt.

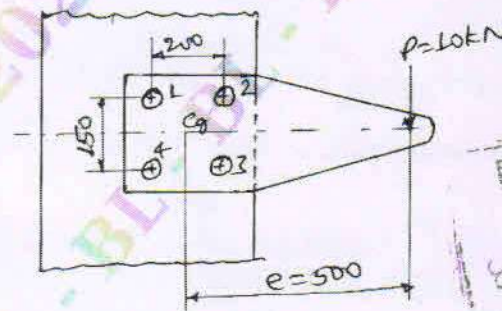


Fig. Q9 (a)

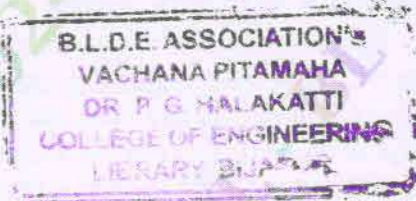
(10 Marks)

- b. A M10 steel bolt of 125 mm long is subjected to an impact load. The kinetic energy absorbed by the bolt is 2.55. Determine
- Stress in the shank of the bolt if there is no threaded portion between the nut and the bolt head.
 - Stress in the shank if the area of the shank is reduced to that of the root area of the thread or the entire length of bolt is threaded.

(10 Marks)

OR

- 10 a. Derive an expression for torque required to raise a load on square threaded screw. (10 Marks)
- b. A square threaded power screw has a nominal diameter of 30 mm and a pitch of 6 mm with double threads. The load as the screw is 6 kN and the mean diameter of the thrust collar is 40 mm. The co-efficient of friction for the screw is 0.1 and the collar is 0.09. Determine
- Torque required to raise the screw against load.
 - Torque required to lower the screw with load.
 - Overhauling efficiency.
- (10 Marks)



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17AU71

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Automotive Electrical and Electronic Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Sketch the diagram of typical wiring system and discuss the symbols used in automobile electrical systems. (10 Marks)
 b. Discuss various methods of battery rating. (06 Marks)
 c. Analyze the effect of temperature on specific gravity of electrolyte. (04 Marks)

OR

- 2 a. Sketch and explain the working of lead acid battery. (10 Marks)
 b. Illustrate the defects and remedies of batteries. (06 Marks)
 c. List the advantages of Lithium Ion battery. (04 Marks)

Module-2

- 3 a. Explain the construction and working of alternator with the help of sketch. (10 Marks)
 b. Discuss the construction and working of cutout relay with sketch. (10 Marks)

OR

- 4 a. List and explain the different drives of starting motor. (10 Marks)
 b. Illustrate the working of series motor and its characteristics. (10 Marks)

Module-3

- 5 a. With the help of circuit diagram explain the working of battery coil ignition system. (10 Marks)
 b. Highlight the significance of ignition advance and explain the different types of ignition advance mechanism. (10 Marks)

OR

- 6 a. Explain the construction of head lamp mounting. (10 Marks)
 b. Sketch and explain the construction of balancing coil type oil pressure gauge. (10 Marks)

Module-4

- 7 a. Illustrate the significance of ECU and discuss how can ECU works. (10 Marks)
 b. List and discuss the different methods of exhaust emission control. (10 Marks)

OR

- 8 a. What is the importance of ABS? List the elements of ABS and the discuss the working of ABS. (10 Marks)
 b. Illustrate the working of traction control system. (06 Marks)
 c. Write a short note on Air bags. (04 Marks)

Module-5

- 9 a. Illustrate the components of EV and discuss its advantages and disadvantages. (10 Marks)
 b. Discuss the significance of hybrid vehicles. (04 Marks)
 c. Write a brief note on mild hybrid and full hybrid. (06 Marks)

OR

- 10 a. Explain the importance working and application of oxygen sensor. (10 Marks)
 b. How are sensors classifications? (05 Marks)
 c. What are hall effect and its uses? (05 Marks)

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Seventh Semester B.E. Degree Examination, Feb./Mar.2022 Automotive Engine Components Design & Auxiliary Systems

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Design data hand book is allowed.

Module-1

- 1 a. With simple sketches, explain the merits and limitations of,
 - (i) Separate and Integral cylinder heads. (10 Marks)
 - (ii) Wet and Dry cylinder liners. (10 Marks)
- b. A vertical four stroke CI engine has the following specifications:
 Brake power = 4.5 kW, Speed = 1200 rpm, imep = 0.35 N/mm², $\eta_{mech} = 0.80$.
 Determine the dimensions of the cylinder. (10 Marks)

OR

- 2 a. With sketches, explain any four methods used to compensate thermal expansion in pistons. (08 Marks)
- b. Determine the thickness of head of a cast iron piston for a single acting 4-stroke engine for the following specifications: Cylinder bore = 100 mm, Stroke = 120 mm, bmep = 0.65 MPa, Maximum gas pressure = 5 MPa, Fuel consumption = 0.227 kg/kW-hr, Speed = 2200 rpm and Calorific value = 41870 kJ/kg. (12 Marks)

Module-2

- 3 a. With a neat sketch, describe the function, material and construction of a connecting rod. (10 Marks)
- b. A reciprocating pump is used to raise the water against a head of 165 kg, pump diameter is 450 mm and piston rod is 1400 mm long. Calculate the diameter of the piston rod. Use Rankine constant $K = \frac{1}{7500}$, FOS = 10, pressure on the piston = 1.61 MPa. (10 Marks)

OR

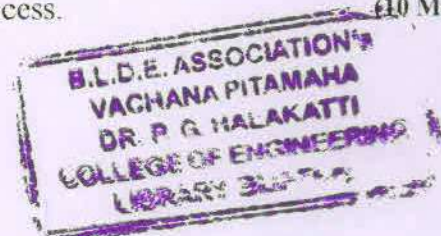
- 4 a. Describe the functions, materials and construction of a Crankshaft. (10 Marks)
- b. Design an overhung Crankpin for an engine having the following particulars:
 Cylinder diameter = 300 mm, Stroke = 500 mm, Maximum explosion pressure = 1.8 MPa, Speed = 200 rpm, Permissible bending stress for pin = 1000 MPa and Permissible bending stress = 85 MPa. (10 Marks)

Module-3

- 5 a. Explain with a neat sketch an over head valve operating mechanism. (10 Marks)
- b. Explain with a neat sketch valve timing importance in an engine. (10 Marks)

OR

- 6 a. With suitable sketches, explain the working of a two-stroke petrol engine. (10 Marks)
- b. With a neat sketch, explain theoretical scavenging process. (10 Marks)



Module-4

- 7 a. Write a note on IC engine manifolds with neat sketches showing inlet and exhaust manifolds for a multi-cylinder engine. (12 Marks)
- b. With neat sketches, explain any two types of mufflers used in IC engines. (08 Marks)

OR

- 8 a. Compare air cooling and water cooling systems. (08 Marks)
- b. Explain with a sketch, the functioning of thermostat assisted cooling system. (12 Marks)

Module-5

- 9 a. Enlist and discuss the important properties of a lubricant (any five). (10 Marks)
- b. Discuss different types of lubricating oil filters commonly used. (10 Marks)

OR

- 10 a. Explain supercharging with a diagram of thermodynamic cycle. (10 Marks)
- b. Explain turbocharging of two stroke engine with a neat sketch. (10 Marks)

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Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Finite Element Modeling and Analysis

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive the differential equation of equilibrium for a body subjected to a three dimensional stress system and body force. (10 Marks)
- b. Write down the equilibrium equation of a 3-D elastic body subjected to body forces, surface forces and point loads in Cartesian co-ordinates. (10 Marks)

OR

- 2 a. Derive the Euler – language equation for an integral function using variational principle. (10 Marks)
- b. Determine the displacements of nodes 1 and 2 in the spring system shown in Fig Q2(b), use minimum of potential energy principle to assemble equations of equilibrium.

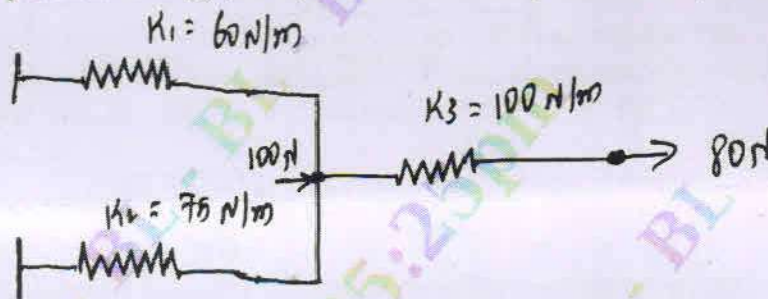


Fig Q2(b)

(10 Marks)

Module-2

- 3 a. Write properties of stiffness matrix K , Show node numbering and its effect on the half bandwidth. (10 Marks)
- b. Determine the displacement in the system shown in Fig Q3(b) and hence determine the displacement at the point of application of load by Galerkin method.

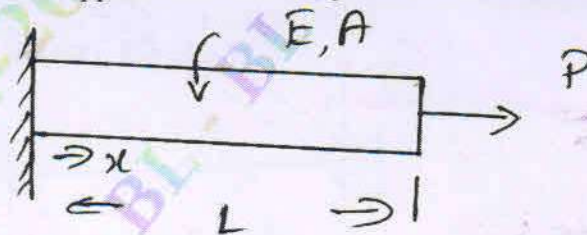


Fig Q3(b)

(10 Marks)

OR

- 4 a. Explain the steps involved in FEM. (08 Marks)
- b. What are the factors considered for discretization process? Explain any one factor. (08 Marks)
- c. What are the properties of shape functions? (04 Marks)

Module-3

- 5 a. Fig Q5(a), show a one dimensional bar subjected to an axial loading. Taking it as a two element, determine i) Nodal displacement ii) Stress in each element iii) Reaction at the support.

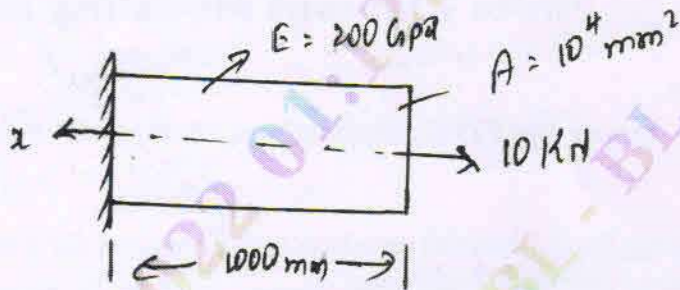


Fig Q5(a)

(10 Marks)

- b. Solve for stresses in members of structure given below in Fig Q5(b) using penalty approach of handling boundary condition.

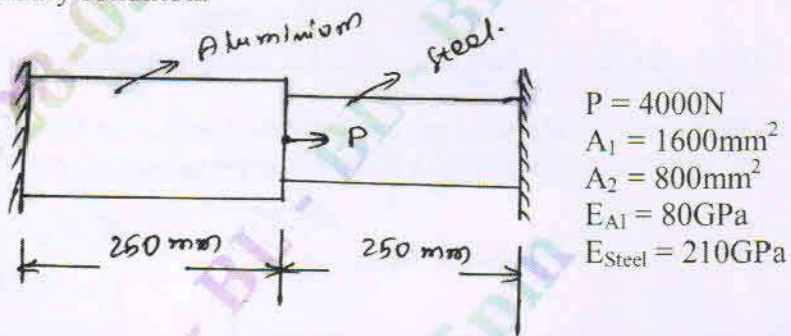


Fig Q5(b)

(10 Marks)

OR

- 6 a. Derive the element stiffness matrix for the truss element. (08 Marks)
 b. For the two bar truss shown in Fig Q6(b). Determine the Nodal displacement and the stress in each member. Also find the support reaction. Take $E = 200 \text{ GPa}$.

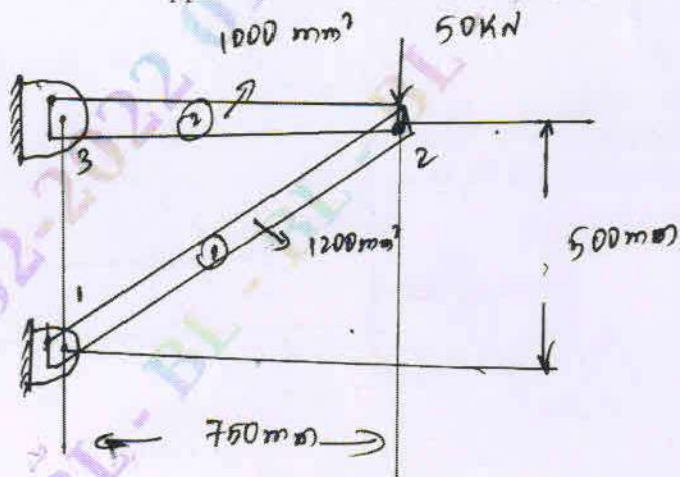


Fig Q6(b)

(12 Marks)

Module-4

- 7 a. Briefly explain iso-parametric sub and super-parametric elements. (06 Marks)
 b. Derive the shape function for the Nine Noded quadrilateral element. (08 Marks)
 c. Explain Lagrange interpolation function. (06 Marks)

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OR

- 8 a. Derive the shape function 3-Node bar element. (10 Marks)
- b. Derive the shape function for Four-Node bar element. (10 Marks)

Module-5

- 9 a. Derive hermite shape function ROF beam element. (10 Marks)
- b. Fig Q9(b) shows a simply supported beam subjected to a uniformly distributed load. Obtain the maximum deflection. Take Young's modulus $E = 200\text{GPa}$ and moment of inertia $I = 2 \times 10^6\text{mm}^4$.

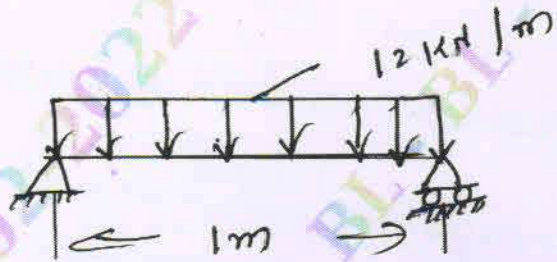
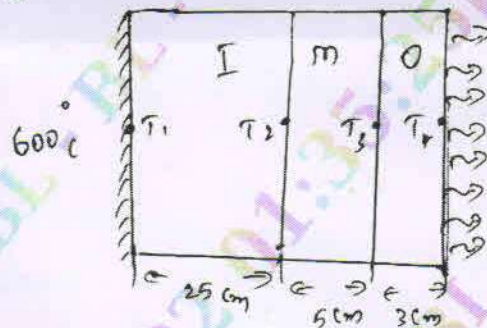


Fig Q9(b)

(10 Marks)

OR

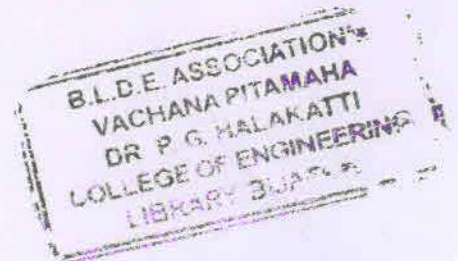
- 10 a. Derive the expression for differential equation for an 1-D Heat conduction. (08 Marks)
- b. An induction durance wall is made up of three layers, inside, middle and outer layer with thermal conductivity K_1 , K_2 and K_3 respectively of shown in Fig Q10(b). Determine the Nodal temperature.



$K_1 = 8.5\text{W/mK}$
 $K_2 = 0.25\text{W/mK}$
 $K_3 = 0.08\text{W/mK}$
 $h = 45\text{W/m}^2/\text{K}$
 $T_s = 30^\circ\text{C}$

Fig Q10(b)

(12 Marks)



CBCS SCHEME

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17AU741

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Earthmoving Equipments and Tractors

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Enlist the different types of Earth Moving Equipment. Briefly explain their application. (10 Marks)
b. Explain the Working, Construction and Applications of a Shovel, with a neat sketch. (10 Marks)

OR

- 2 a. Briefly discuss the working of motor grader, with simple line diagram. (10 Marks)
b. Draw a neat sketch of Scraper and explain their application. (10 Marks)

Module-2

- 3 a. Explain the importance of Turbocharger and After cooler in earth moving vehicle engine. (10 Marks)
b. With the aid of neat sketch, briefly explain the under carriage components of Earthmoving vehicle. (10 Marks)

OR

- 4 a. Explain the advantages and disadvantages of Wheeled and Crawler tractors. (10 Marks)
b. Write brief notes on :
i) Rubber Spring Suspension ii) Air Spring Suspension. (10 Marks)

Module-3

- 5 a. List the basic types of transmission used in Earth moving vehicles and explain any one type in detail. (10 Marks)
b. What is PTO shaft? Explain the working and application in tractors. (10 Marks)

OR

- 6 a. With neat sketch, explain the Construction and Working of a Planetary steering system. (10 Marks)
b. Explain the Construction and Working of a disc brake mechanisms in tractors. (10 Marks)

Module-4

- 7 a. Sketch and explain the Hydraulic system with basic components. (10 Marks)
b. Write short note on :
i) Direct Acting pressure relief valve ii) Pressure Control valves. (10 Marks)

OR

- 8 a. Explain the function of following components in hydraulic system :
i) Pumps ii) Control valves iii) Hydraulic motor iv) Hydraulic cylinder. (10 Marks)
b. Explain the Depth and Draft Control System, with a simple line diagram. (10 Marks)

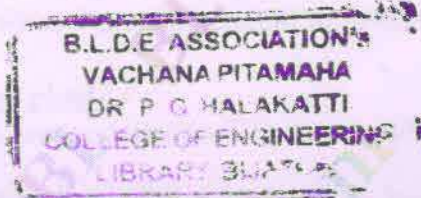
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-5

- 9 a. Discuss the types of maintenance and state the purpose with advantages in Earth Moving Equipments. (10 Marks)
- b. Discuss the various Safety measures adopted in Earth Moving Equipments. (10 Marks)

OR

- 10 a. Discuss the various considerations while selecting Earth Moving Equipments for different activities. (10 Marks)
- b. Write short notes on :
- i) Operation Capacity ii) Productivity of Bulldozers. (10 Marks)



CBCS SCHEME

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17AU753

Seventh Semester B.E. Degree Examination, Feb./Mar.2022 Operations Research

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the various phases of a operation research. (10 Marks)
 b. A farmer has 100 acre farm. He can sell all tomatoes, lettuce or radishes he can raise. The price he can obtain is Rs.1.00 per kg for tomatoes, Rs.0.75 a heat for lettuce and Rs.2.00 per kg for radishes. The average yield per acre is 2,000 kg of Tomatoes, 3000 heads of lettuce and 50 kgs for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400-man days of labour are available at Rs.20.00 per man day. Formulate this problem as a linear programming model to maximize the farmers total profit. (10 Marks)

OR

- 2 a. Discuss the characteristics and limitations of operations research. (10 Marks)
 b. Solve the following LPP using two phase method:

$$\text{Max } z = -4x_1 - 3x_2 - 9x_3$$

Subject to

$$2x_1 + 4x_2 + 6x_3 \geq 15$$

$$6x_1 + x_2 + 6x_3 \geq 12$$

$$x_1, x_2, x_3 \geq 0$$

(10 Marks)

Module-2

- 3 a. State the common and distinguishing features of transportation problem and assignment problem. (06 Marks)
 b. A company has three plants at locations A, B and C which supply to ware houses located at D, E, F, G, H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation cost is Rs. are given below. Determine an optimum distribution for the company in order to minimize the total transportation cost.

	D	E	F	G	H
A	5	8	6	6	3
B	4	7	7	6	6
C	8	4	6	6	4

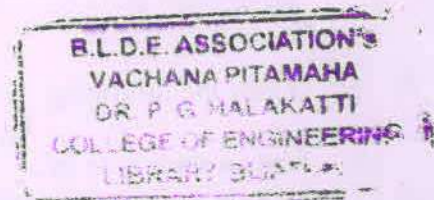
(14 Marks)

OR

- 4 a. Given below is the time required (in days) when a particular software program module is assigned to a particular programmer.

	Programmers				
	A	B	C	D	
Modules	1	12	10	8	9
	2	8	9	11	7
	3	11	14	12	10
	4	9	9	8	9

Assign the modules to the different programmers in such a way that the total computing time is lost. (10 Marks)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. A salesman has to visit five cities A, B, C, D and E. The distance ($\times 10^2$ kms) between any two cities are given in the following table. The salesman starts from A and has to come back to A after visiting all other cities in a cycle. Which route he has to select so that the total distance travelled by him is minimum.

-	4	7	3	4
4	-	6	3	4
7	6	-	7	5
3	3	7	-	7
4	4	5	7	-

(10 Marks)

Module-3

- 5 a. Maximize $z = x_1 + 2x_2$

Subject to, $x_1 + 2x_2 \leq 12$

$$4x_1 + 3x_2 \leq 14$$

$x_1, x_2 \geq 0$ and are integers. Solve by Gomory's technique.

(10 Marks)

- b. Use branch and bound technique to solve the following problem :

$$\text{Max } z = 2x_1 + 2x_2$$

Subject to, $5x_1 + 3x_2 \leq 8$

$$x_1 + 2x_2 \leq 4$$

$x_1, x_2 \geq 0$ and are integers.

(10 Marks)

OR

- 6 a. Briefly explain the characteristics of Queing system. (10 Marks)
- b. Customers arrive at a sales counter managed by a single person, according to Poisson's process with a mean rate of 20 per hour. The time required to serve a customer has an exponential distribution with mean of 100 seconds. Find
- Average waiting time of a customer in the system.
 - Probability that a customer will have to wait for at least 10 minutes?
 - What time on an average, the sales counter cashier is idle? (10 Marks)

Module-4

- 7 a. Differentiate between PERT and CPM, mention the applications of PERT/CPM. (08 Marks)
- b. A project consists of a series of tasks labeled A, B, C, D, E, F, G, H, I with following relationships (W<X, Y means X and Y cannot start until W is completed). With this notation, construct the network diagram having the following constraints:
 $A < D, E$; $B, D < F$; $C < G$; $C < H$; $F, G < I$
 Find also the optimum times of completion of the project when the time (in days) of completion of each task is as follows:

Task :	A	B	C	D	E	F	G	H	I
	23	8	20	16	24	18	19	4	10

Also calculate total float for each activity.

(12 Marks)

OR

- 8 a. Define the following: (i) Network (ii) Activity (iii) Dummy activity
 (iv) Event (v) Merge and burst event. (10 Marks)
- b. Write a short note on:
- Crashing of simple projects
 - Critical path method. (10 Marks)

Module-5

- 9 a. Solve the following game with the pay off matrix,

(08 Marks)

Player A	Player B			
	A ₁	B ₁	B ₂	B ₃
A ₁	1	7	3	4
A ₂	5	6	4	5
A ₃	7	2	0	3

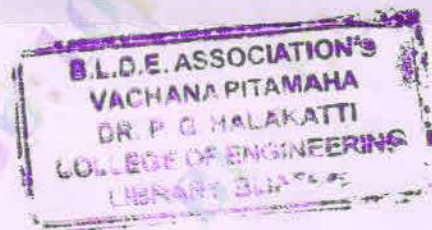
- b. Define saddle point, strategy, zero sum game, pay off matrix, minimax principal. (12 Marks)

OR

- 10 a. State assumptions made while applying Johnson's rule to 'n Jobs on 2 machines' (06 Marks)
 b. Find the total minimum elapsed time using the CDS heuristic for the following shop problem.

Job (J)	M/C 1 (hrs)	M/C 2 (hrs)	M/C 3 (hrs)	M/C 4 (hrs)
1	8	6	14	16
2	6	14	4	10
3	2	4	8	14
4	6	8	6	4

(14 Marks)



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18AU71

Seventh Semester B.E. Degree Examination, Feb./Mar.2022 Finite Element Modeling and Analysis

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive an differential equation of equilibrium for a two dimensional body. (08 Marks)
- b. Solve the following of simultaneous system equation by Gaussian elimination method:

$$\begin{aligned} x_1 - 2x_2 + 6x_3 &= 0 \\ 2x_1 + 2x_2 + 3x_3 &= 3 \\ -x_1 + 3x_2 &= 0 \end{aligned}$$
(08 Marks)
- c. List the advantages and applications of FEM. (04 Marks)

OR

- 2 a. For the spring system shown in Fig. Q2 (a), using the principle of minimum potential energy. Determine the nodal displacements. Take : $F_1 = 75 \text{ N}$ and $F_2 = 100 \text{ N}$ (10 Marks)

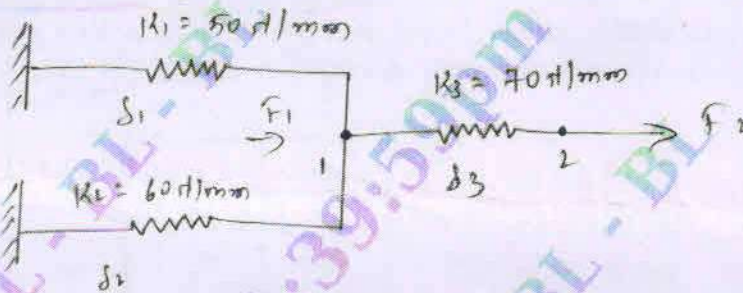


Fig. Q2 (a)

- b. By R - R method, for a bar of cross sectional area of elastic modulus E, subjected to a uniaxial loading P. Show that at a distance x from fixed end is $u = \left(\frac{P}{AE}\right)x$ and hence determine the end deflection and the stress to which the bar is subjected to. (10 Marks)

Module-2

- 3 a. Explain the basic steps involved in FEM. (08 Marks)
- b. Explain convergence requirements of a displacement field. (04 Marks)
- c. Use Galerkin method, to find the displacement of the system shown in Fig. Q3 (c). (08 Marks)

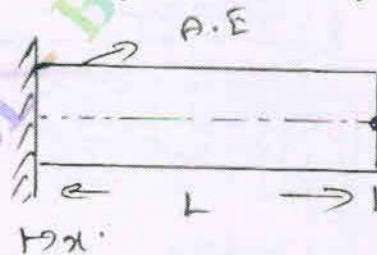
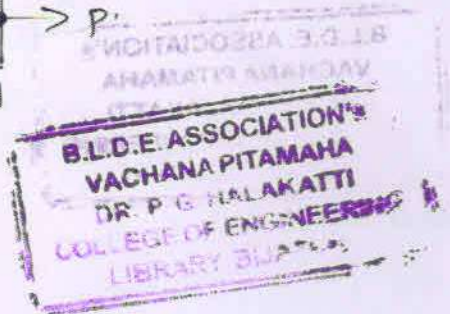


Fig. Q3 (c)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 4 a. Derive the shape function of a bar element in Global co-ordinate system. (10 Marks)
- b. What is the purpose of Pascal's (2D Pascal's) triangle? (05 Marks)
- c. Write a note on simplex, complex and multiplex element. (05 Marks)

Module-3

- 5 a. A bar is having uniform cross sectional area of 300 mm^2 and is subjected to a load $P = 600 \text{ KN}$ as shown in Fig. Q5 (a). Determine the displacement field, stress and support reaction in the bar. Consider two element and use elimination method to handle boundary conditions. Take $E = 200 \text{ GPa}$. (10 Marks)

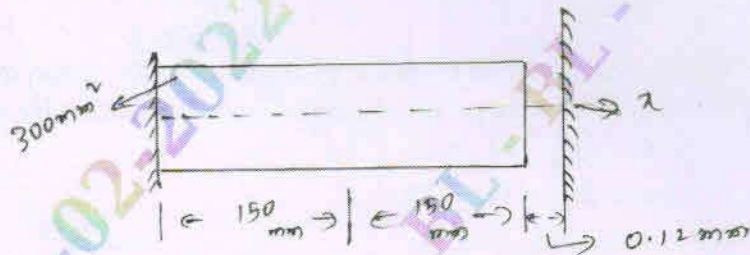


Fig. Q5 (a)

- b. Determine the nodal displacement, stress in each element at the fixed support for the thin plate of uniform thickness of 1 mm of shown in Fig. Q5 (b). Take Young's modulus $E = 200 \text{ GPa}$, Weight density of the plate $P = 76.6 \times 10^{-6} \text{ N/mm}^3$. In addition to its weight, it is subjected to a point load of 100 N at its mid point. Model the plate with two bar elements. (10 Marks)

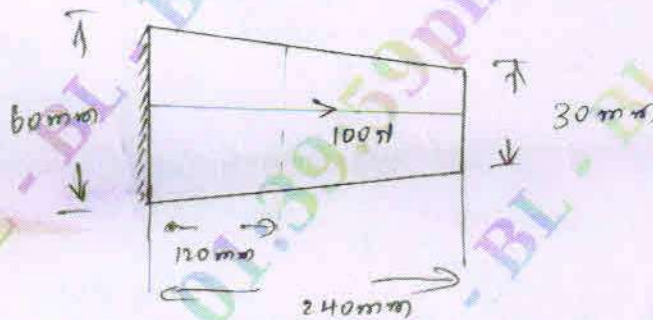


Fig. Q5 (b)

OR

- 6 a. Derive element stiffness matrix for truss method. (10 Marks)
- b. For the two bar truss shown in Fig. Q6 (b). Determine the nodal displacement and the stress in each member. Also find the support reaction. Take $E = 200 \text{ GPa}$.

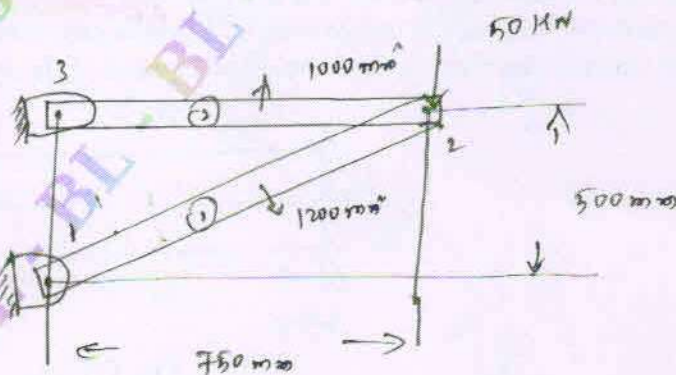


Fig. Q6 (b)
2 of 3

(10 Marks)

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NERUR, BIALUR

Module-4

- 7 a. Derive shape function for 2-D elements quadrilateral/rectangular element. (08 Marks)
 b. Explain the following with neat sketch:
 (i) Iso-parametric element.
 (ii) Sub-parametric element.
 (iii) Super-parametric element. (06 Marks)
- c. Compute the value of integral $\int_{-1}^{+1} \left(3e^{\xi} + \xi^2 + \frac{1}{\xi+2} \right) d\xi$ using one point and two point Gaussian quadrature. (06 Marks)

OR

- 8 a. Derive element stiffness matrix for beam element using shape function. (10 Marks)
 b. Fig. Q8 (b) shows a simply supported beam subjected to a uniformly distributed load. Obtain the maximum deflection. Take Young's modulus $E = 200 \text{ GPa}$ and moment of inertia $I = 2 \times 10^6 \text{ mm}^4$.

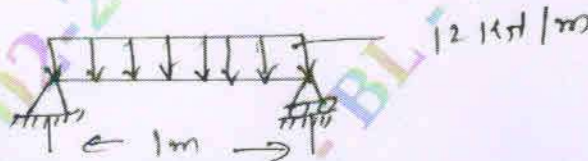


Fig. Q8 (b)

(10 Marks)

Module-5

- 9 a. Derive Hermite shape function for beam element. (10 Marks)
 b. An induction furnace wall is made up of three layers, inside, middle and outer layer with thermal conductivity K_1, K_2 and K_3 respectively shown in Fig. Q9 (b). Determine nodal temperature. (10 Marks)

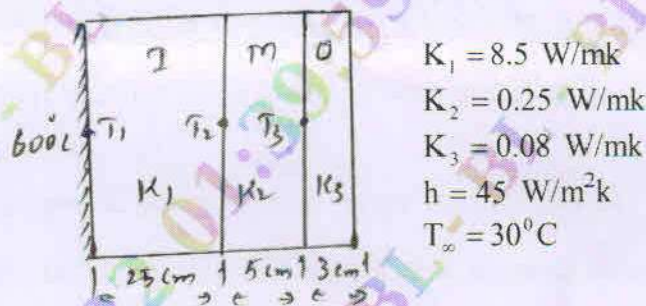


Fig. Q9 (b)

OR

- 10 a. Derive equation for heat transfer through thin fin's. (10 Marks)
 b. Determine the temperature distribution in a one dimensional fin shown in fig. Q10 (b). There is a generation uniform heat inside the wall of 500 W/m^3 .

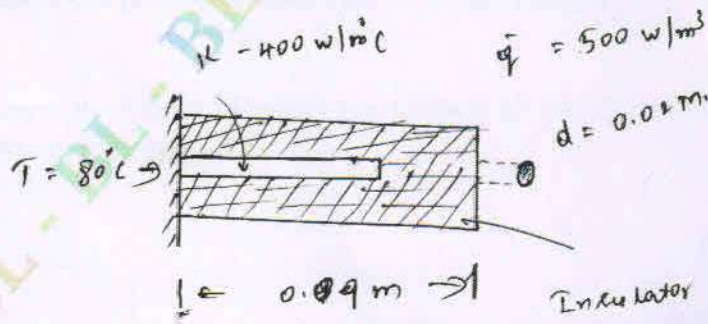
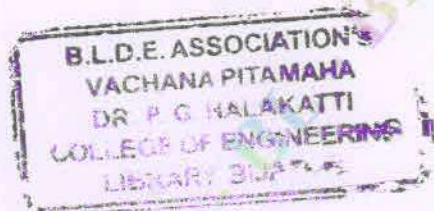


Fig. Q10 (b)

(10 Marks)



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18AU72

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Automotive Electrical and Electronic Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With neat sketch, explain earthed and insulated return system. Mention its advantages and disadvantages. (10 Marks)
- b. Explain the following:
- 6 volts and 12 volts systems
 - Fusing of circuits
 - Low and High voltage automobile cables. (10 Marks)

OR

- 2 a. Describe the construction and working of lead acid battery with neat sketch. (10 Marks)
- b. Explain the different methods of battery testing. With neat sketch explain any two methods. (10 Marks)

Module-2

- 3 a. With the aid of neat sketch, describe the operation of combined voltage and current regulator with its principle. (10 Marks)
- b. Explain the construction, working of an alternator with neat sketch. (10 Marks)

OR

- 4 a. Mention the different types of starting motor drives. Explain any one type with neat sketch. (10 Marks)
- b. Explain battery motor starting system with neat sketch. Mention the consideration affecting the size of the motor. (10 Marks)

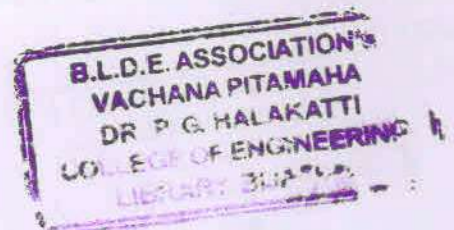
Module-3

- 5 a. With a neat sketch, explain the magnetic ignition system for an S.I. engine. Mention the advantages of it. (10 Marks)
- b. With the help of simplified diagram, explain the principle of an electronic ignition system.
- c. Discuss in detail about the pulse generator type of timers used in the system. (10 Marks)

OR

- 6 a. What are sealed beam head light? Explain the method of adjusting sealed beam headlight with sketch state its advantages. (10 Marks)
- b. Explain the following with neat sketch:
- Electric horn
 - Temperature gauge. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



Module-4

- 7 a. What is ignition timing? Explain the various timing device used to adjust the timing of an engine. (10 Marks)
- b. Write a short notes on:
- Hybrid vehicles
 - Fuel cells
 - Injection duration. (10 Marks)

OR

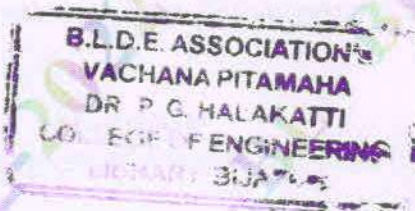
- 8 a. With neat sketch, explain the following:
- Electronic control of automatic transmission. (10 Marks)
 - Central door locking. (10 Marks)
- b. Describe the construction and working of ABS. What are the disadvantages associated with them? (10 Marks)

Module-5

- 9 a. Explain the construction and working principle of sodium sulphur battery for electric vehicle with neat sketch. (10 Marks)
- b. i) List out the advantages and disadvantages of electric vehicles. (10 Marks)
- ii) Write short notes on HEV. (10 Marks)

OR

- 10 a. Define transducer. Explain the working principle of transducer used in Automobile and classify them. (10 Marks)
- b. Explain the following:
- Hall effect
 - Proximity sensors. (10 Marks)



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18AU732

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Earthmoving Equipment and Tractors

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With neat sketch, explain construction and working of bulldozer. (08 Marks)
b. Discuss the function of following with sketches: i) Excavators ii) Scrapers. (12 Marks)

OR

- 2 a. Explain the following with diagram i) Motor graders ii) Compactors. (12 Marks)
b. Discuss the various attachments of tractors and mention their applications. (08 Marks)

Module-2

- 3 a. Explain Construction and working of turbocharger, with neat sketch. (10 Marks)
b. Explain working of automatic Injection timer, with neat sketch. (10 Marks)

OR

- 4 a. Compare tyred and tracked type and vehicles. (10 Marks)
b. Explain the following : (10 Marks)
i) Rubber spring suspension ii) Air spring suspension.

Module-3

- 5 a. With a neat sketch, explain the construction and working of twin counter shaft transmission system. (10 Marks)
b. List the basic types of transmission used in earth moving vehicles and explain planetary transmission with sketch. (10 Marks)

OR

- 6 a. Explain single and double reduction final drive with neat sketches. (10 Marks)
b. Discuss the purpose of PTO shaft in tractors. (10 Marks)

Module-4

- 7 a. With simple line diagram, explain the depth and draft control systems. (10 Marks)
b. Explain construction and working of double acting hydraulic cylinder with neat sketch. State the functions. (10 Marks)

OR

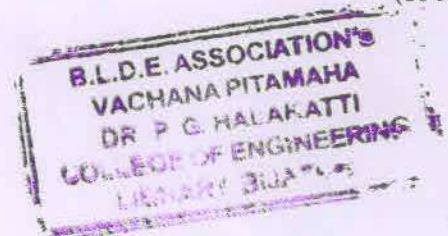
- 8 a. Explain construction and working of vane type motor with neat diagram. (08 Marks)
b. Explain the functions of following components (12 Marks)
i) Flow control valves ii) Direction control valves iii) Pumps.

Module-5

- 9 a. Discuss the various considerations, while selecting earth moving equipments for different activities. (10 Marks)
b. Explain the factors affecting the productivity of bulldozer. (10 Marks)

OR

- 10 a. Explain the various safety measures adopted for earth moving equipments. (10 Marks)
b. Discuss the types of maintenance and state its purpose, with advantages in earth moving equipments. (10 Marks)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

CBCS SCHEME

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18AU742

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Operations Research

Time: 3 hrs.

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Normal distribution function tables are allowed.
3. Use to graph sheets if required.

Module-1

1. a. Define operations research. Briefly explain the applications of operations research. (05 Marks)
b. Classify the various models used in operations research. (03 Marks)
c. A paper mill produces two grades of paper namely 'X' and 'Y'. Because of raw material restrictions, it cannot produce more than 400 tonnes of grade 'X' and 300 tones of grade 'Y' in a week. There are 160 production hours in a week. It requires 0.2 and 0.4 hours to produce one ton of products X and Y respectively. With corresponding profit of Rs. 200 and Rs. 500/ton. Formulate the problem as a LPP and solve graphically to find the optimal product mix that maximize the profit. (12 Marks)

OR

2. a. What is degeneracy in LPP? How you resolve the same? (06 Marks)
b. Solve by two-phase method :

$$\text{Minimize } Z = \frac{15}{2}x_1 - 3x_2$$

$$\text{Subject to } 3x_1 - x_2 - x_3 \geq 3$$

$$x_1 - x_2 + x_3 \geq 2$$

$$x_1, x_2, x_3 \geq 0.$$

(14 Marks)

Module-2

3. a. Differentiate between transportation and assignment problem. (05 Marks)
b. Solve the following transportation problem for optimal solution, use u, v method and MODI methods for checking optimality.

	Warehouses				
	W ₁	W ₂	W ₃	W ₄	Supply
F ₁	19	30	50	10	7
F ₂	70	30	40	60	9
F ₃	40	08	70	20	18
Demand	5	8	7	14	

(15 Marks)



OR

- 4 a. A company has 4 machines on which 3 jobs are to be done each job can be assigned to one machine. The cost of each job on each machine is given in the table below. What are the job assignments that will minimize the cost? Which machine will be idle?

		Machines			
		W	X	Y	Z
Jobs	A	18	24	28	32
	B	8	13	17	19
	C	10	15	19	22

(08 Marks)

- b. A salesman has to visit cities A, B, C, D and E. The distance (in kms) between five cities are as below :

		To				
		A	B	C	D	E
From	A	∞	6	12	6	4
	B	6	∞	10	5	4
	C	8	7	∞	11	3
	D	5	4	11	∞	5
	E	5	2	7	8	∞

If the salesman starts from city 'A' and come back to city 'A' which route should be select to minimize the travel distance?

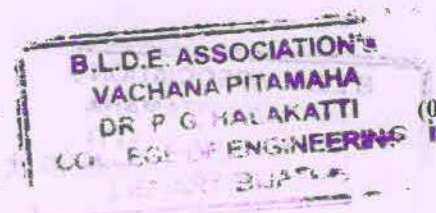
(12 Marks)

Module-3

- 5 a. What is integer programming? Mention any 3 examples. (04 Marks)
- b. Solve the integer programming problem using branch and bound algorithm.
 Maximize : $Z = 2x_1 + 3x_2$
 Subject to $6x_1 + 5x_2 \leq 25$
 $x_1 + 3x_2 \leq 10$
 x_1, x_2 non-negative integer. (16 Marks)

OR

- 6 a. Explain the Six basic characteristics of a queuing system. (06 Marks)
- b. A box office ticket window is being manned by a single server. Customers arrive to purchase tickets according to Poisson input process with a mean rate of 30/hour. The time required to serve is exponentially distributed with a mean of 90 secs. Calculate :
- Mean queue length
 - Mean line length
 - Mean waiting time in the system
 - Mean waiting time in the line. (10 Marks)
- c. Define :
- Balking
 - Reneging
 - Jockeying behavior of a customer in a queue. (04 Marks)



Module-4

- 7 a. Draw the project networks, find critical path and duration of the project.

Activity	1-2	1-3	1-4	2-6	3-7	3-5	4-5	5-9	6-8	7-8	8-9
Duration (days)	2	2	1	4	5	8	3	5	1	4	3

(08 Marks)

- b. Determine the expected time and variance for each activity. Draw the networks diagram, find the critical path and the probability of completing the project in 41.5 weeks.

Activity	1-2	1-3	1-4	2-5	2-6	3-6	4-7	5-7	6-7
T_0	5	18	26	16	15	6	7	7	3
T_m	8	20	33	18	20	9	10	8	4
T_p	10	22	40	20	25	12	12	9	5

(12 Marks)

OR

- 8 a. Define :
- Free float
 - Total float
 - Independent float.

(06 Marks)

- b. The list of jobs, duration and cost is given in the table below : Find the optimum duration and cost if indirect cost is Rs.50/day.

Activity	Normal (days)		Crash (Rs.)	
	Duration	Cost	Duration	Cost
1-2	03	50	02	100
1-4	06	140	02	260
1-3	02	50	01	80
2-4	05	100	03	180
3-5	02	50	02	50
2-5	07	120	05	180
4-5	04	100	02	240

(14 Marks)

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Module-5

9 a. Define :

- i) Saddle point
- ii) Min max/max min criterion
- iii) Pure strategy
- iv) Mixed strategy.

(04 Marks)

b. Solve the game by the principle of dominance :

		Player B		
		I	II	III
Player A	I	-4	6	3
	II	-3	-3	4
	III	2	-3	4

(08 Marks)

c. Solve graphically :

		Player B		
		I	II	III
Player A	I	4	-1	0
	II	-4	4	2

(08 Marks)

OR

- 10 a. Define sequencing. List any 06 important assumptions made in solving the sequencing problem. (06 Marks)
- b. What is Johnson's algorithm? Describe the procedure for a standard n-jobs, two machine problem. (04 Marks)
- c. It is required to process the following two jobs on various machines, shown below : Find for each machine, which job should be done first and calculate the total elapsed time. Use graphical solution.

Job 1	Sequence	A	B	C	D	E
	Time (Hrs)	7	9	5	13	5

Job 2	Sequence	B	C	A	D	E
	Time (Hrs)	11	9	7	5	13

(10 Marks)

CBCS SCHEME

USN

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18AU751

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Engineering Economics and Cost Estimation

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of interest factor tables permitted.*

Module-1

- 1 a. Briefly explain the law of demand and supply. (10 Marks)
b. Define the following economic terms:
i) Economic goods
ii) Utility
iii) Value in exchange
iv) Price and wealth
v) Rent and profit. (10 Marks)

OR

- 2 a. Explain the law of returns and law of substitution with examples. (10 Marks)
b. Explain elasticity of demand and supply. What are the factors influencing the elasticity of demand and supply? (10 Marks)

Module-2

- 3 a. State and explain Gresham's law. What are the limitations of this law? (10 Marks)
b. Define money. Explain the functions of money. (10 Marks)

OR

- 4 a. Write a short notes on: i) Value of money ii) Index numbers iii) Vehicle insurance. (10 Marks)
b. Define principle of taxation. Briefly explain different kinds of taxes. (10 Marks)

Module-3

- 5 a. A person takes a loan of Rs.10,000 from HDFC bank at interest of 10% PA. Find the amount if
i) Interest is compounded annually
ii) Interest is compounded half yearly
iii) Interest is compounded quarterly
iv) Interest is compounded monthly
(Assume $n = 1$ year). (10 Marks)
b. Explain the interest rate from borrower's and lender's point of view with cash flow diagram. (10 Marks)

OR

- 6 a. A CNC machine costs Rs.30,00,000 is estimated to serve for 8 years after which its salvage value is estimated to be Rs.2,50,000. Find:
i) Depreciation fund at the end of the 5th year by fixed percentage method.
ii) Book value of the machine after 4th year and 6th year by declining balance method. (10 Marks)
b. What are the different methods of depreciation charges? Explain any two of them. (10 Marks)

Module-4

- 7 a. A MICO factory produces 500 spark plugs a day involving direct material costs of Rs.40,000. Direct labour cost of Rs.35,000 and factory over heads of Rs.10,000. Assuming a profit of 15% of the selling price and selling overheads to be 30% of the factory cost. Determine the selling price of the one spark plug. (10 Marks)
- b. Explain the components of cost. (10 Marks)

OR

- 8 a. The cost of the machine is 6100 and its scrap value is Rs.100. The maintenance cost round from experience are as follows:

Year	1	2	3	4	5	6	7	8
Maintenance cost	100	250	400	600	900	1200	1600	2000

Where should the machine replaced? (10 Marks)

- b. A company has three proposals for expanding its business operations. The details are as follows:

Alternative	Initial cost	Annual revenue	Life years
A ₁	25,00,000	8,00,000	10
A ₂	20,00,000	6,00,000	10
A ₃	30,00,000	10,00,000	10

Each alternative has insignificant salvage value at the end of its life. Assuming an interest rate of 15% compounded annually. Find the best alternative for expanding the business operations of the company using the annual equivalent method. (10 Marks)

Module-5

- 9 a. Following is the financial states of a company as on 31st March 2021.

Sundry debtors	Rs.10,000
Cash in hand	Rs.22,000
Bank loans	Rs.40,000
Bills payable	Rs.20,000
Equity shares	Rs.1,13,000
Land and Buildings	Rs.50,000
Plant and machinery	Rs.15,000
Creditors	Rs.30,000
Bank balance	Rs.16,000

Prepare a balance sheet as on 31st March 2021. (10 Marks)

- b. Define book keeping. Explain the systems of book keeping. (10 Marks)

OR

- 10 a. Explain the different steps involved in estimating procedure. (10 Marks)
- b. Define cost estimation. What are the objectives and functions of cost estimation? (10 Marks)

CBCS SCHEME

USN

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18AU752

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Total Quality Management

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define the TQM and explain the TQM framework. (10 Marks)
b. Write the contribution of Juran to TQM. (10 Marks)

OR

- 2 a. Define leadership. Briefly explain the characteristics of successful quality leader. (10 Marks)
b. Explain the six basic concepts of TQM. (10 Marks)

Module-2

- 3 a. Sketch and explain the Juran's Trilogy. (10 Marks)
b. Explain the following continuous process improvement : i) PDCA ii) Kaizen. (10 Marks)

OR

- 4 a. Define Bench marking. Explain the process of benchmarking. (10 Marks)
b. Explain the quality function deployment and list the benefits. (10 Marks)

Module-3

- 5 a. Explain the affinity diagram and tree diagram briefly. (10 Marks)
b. Explain the activity networks diagram tool of quality management. (10 Marks)

OR

- 6 a. Explain the matrix diagram with respect to quality management tool. (10 Marks)
b. Explain the process decision program chart. (10 Marks)

Module-4

- 7 a. Define recruitment and explain the process of recruitment. (10 Marks)
b. Define human resource management. Discuss the scope and importance of human resource management. (10 Marks)

OR

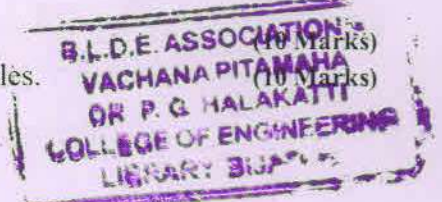
- 8 a. Write a short notes on :
i) Employee well-being
ii) Healthy and safety. (10 Marks)
b. Explain the process training and education in the human resource management. (10 Marks)

Module-5

- 9 Explain briefly the 7 basic tools of statistical process control with neat graph/charts. (20 Marks)

OR

- 10 a. Briefly discuss the control charts for variable with example. (10 Marks)
b. Explain the scatter diagram to find the relationship with variables. (10 Marks)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.